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Central Intelligence Agency

Washington, D.C. 20505

DEC 1984

MEMORANDUM FOR: The Honorable Robert C. McFarlane
Assistant to the President for
National Security Affairs

SUBJECT: Requested Studies on Soviet Energy Development and its Strategic Implications for East-West Relations 25X1

1. The attached three studies examining Soviet energy development and its strategic implications for East-West trade have been prepared based on the four principal subject areas identified in your tasking memorandum of 10 September 1984 and the additional questions raised, via NSC, by the Department of Commerce. The first study, "Soviet Strategy Regarding Energy Exports", examines Soviet hard currency requirements and concludes that Moscow has the potential to double hard currency export earnings from oil and gas by the end of the century. The key determinants will be the level of domestic oil production and the ability of the Soviet Union to export additional gas to Western Europe in the 1990s. The USSR has the incentive and the capability to offer increased volumes of gas for export at prices below those available from prospective competing sources. 25X1 25X1

2. The study titled "Western Energy Technology and Equipment as a Factor in Soviet Energy Prospects" concludes that effective denial of Western oil and gas technology and equipment (requiring at a minimum full and broad cooperation by the COCOM countries) could prevent enhancement of specialized military capabilities and impair Soviet efforts to maintain oil production at a high level. Even though certain gas development projects might be halted by the denial, the USSR would still be able to raise gas production substantially by increasing West Siberian output. Our analysis in the final study, "Western Markets for

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Soviet Energy" concludes that if substantial progress on the development of indigenous, West European gas resources is not achieved in the next few years, Soviet gas could account for half of West European supply by the year 2000. Current European attitudes in favor of increased East-West trade may encourage further purchases of Soviet energy. Although the Japanese will buy Soviet natural gas if the price is right, Moscow will be only a marginal supplier of natural gas to Japan through the end of the century. 25X1

3. We will, of course, continue to monitor developments on these issues and will remain in contact with Bill Martin, Roger Robinson and Dave Wigg on any additional work which may be required to integrate the results of these three studies. 25X1

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Robert M. Gates
Deputy Director for Intelligence

Attachment:
<u>Western Markets for Soviet Energy</u> 25X1
GI M 84-10223 December 1984

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Central Intelligence Agency

Washington, D.C. 20505

DIRECTOR OF INTELLIGENCE

6 December 1984

Western Markets for Soviet Energy

Summary

The Soviet Union has emphasized increased energy exports to the West as a means of earning hard currency. Although oil and coal will continue to earn Moscow hard currency, neither has the growth potential of natural gas. Despite the availability of adequate indigenous resources in Western Europe, the current gas surplus, together with Soviet marketing efforts, could prevent or delay development of new projects needed to meet West European demand requirements in the 1990s. Japanese interest in Soviet energy projects is based principally on a desire to sell equipment. Tokyo may, however, purchase competitively priced Soviet energy as part of its strategy to reduce energy costs. Concerns over undue dependence on Soviet imports should help limit the size of additional purchases. Nevertheless, if substantial progress on the development of indigenous Western gas resources is not achieved over the next few years because of weak demand, the high price of new gas, and stringent tax structures, Soviet gas may account for half of Western Europe's gas supply, and earn Moscow close to $25 billion a year, by 2000. Until West European governments view gas supply availability in a regional strategic perspective, the coordination necessary to use effectively Europe's gas system during a disruption is highly unlikely. [redacted] 25X1

This memorandum was prepared by [redacted] Energy Markets Branch, Office of Global Issues; [redacted] Western Europe Division, Office of European Analysis; and [redacted] Japan Branch, Office of East Asian Analysis. The information contained herein is updated to 29 November 1984. Comments may be directed to [redacted] Chief Strategic Resources Division [redacted]

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[redacted]

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Western Markets for Soviet Energy

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Western Markets for Soviet Energy

Over the last two decades Moscow has emphasized increased energy exports to the West to earn the hard currency necessary to purchase Western grain, technology, and equipment. At best we believe Soviet oil revenues will remain flat and increases in the much smaller volume of coal exports will depend almost entirely on Japanese purchases from a joint development project in Yakutsk. In view of Moscow's need for hard currency earnings, increased natural gas exports will be central to Soviet energy export policy in the 1980s and into the 1990s. [redacted] 25X1

Reduced natural gas demand and a surplus of available supplies in Western Europe, however, have sharply reduced its willingness to buy Soviet gas in this decade. In response, Moscow has undertaken a concerted gas-marketing effort, cutting some prices and attempting to penetrate new markets--an effort that has the potential to limit sales by other gas suppliers to the West European market. Given its abundant gas reserves, pricing flexibility, and the ability to deliver gas with relatively short lead times, Moscow is well placed to capture any growth in West European gas demand in the 1990s and beyond. [redacted] 25X1

[redacted] 25X1

For Western Europe to avoid increasing dependence on Soviet gas imports in the 1990s, decisions to develop new indigenous gas supplies must be made within the next year or so. The known but as yet undeveloped gas fields in the North Sea, particularly the Norwegian Troll field, are expected to be very costly and to have leadtimes as long as 10 years. Furthermore, [redacted] 25X1

[redacted] negotiations for the sale of Troll gas may not 25X1 proceed unless the sale of gas from Norway's Sleipner field is successfully concluded. Under the existing tax structure, however, it is doubtful whether new Norwegian gas can compete favorably against low-cost Soviet supplies, especially in view of Moscow's aggressive gas marketing tactics. In our judgment, if new sources of gas are not available in the mid 1990s, Western Europe could find itself dependent on Soviet gas for as much as half of gas consumption. Moreover, such purchases could generate close to $25 billion a year for Moscow in hard currency earnings by 2000. ([redacted] 25X1

Current Gas Market

According to the trade press, the main concern in international gas markets over the past year or so has shifted from lining up new supplies to absorbing contracted gas deliveries because of depressed demand. After steadily increasing during the 1960s and 1970s, gas consumption declined sharply in Western Europe and the growth in consumption slowed considerably in Japan during 1980-82. The world economic recession that began in 1980, combined with the sharp escalation in international gas prices in recent years, was responsible for the large but temporary reduction in gas use. [redacted] 25X1 25X1

[redacted]

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Published data indicate that natural gas accounts for approximately 15 percent of total West European energy use, and industry sources expect it to maintain that share of the overall energy mix through the end of the century. In response to the price shocks of 1979-1980 and the subsequent economic recession, total West European natural gas demand declined by over 5 percent between 1979 and 1982, but in 1983 rose about 4 percent. Preliminary estimates for the first half of 1984 show that gas demand continued its strong growth, rising 9 percent above year-earlier levels.

About one-fifth of all gas consumed in Western Europe in 1983 came from Algeria and the Soviet Union, although some countries were more dependent on Soviet imports than others. All of the gas consumed in Finland, for example, is purchased from the Soviet Union. Soviet gas sales to Austria cover 70 percent of Vienna's gas needs. Italy already depends on Soviet gas for nearly half its imports, or 28 percent of its gas consumption. West Germany and France also rely heavily on Soviet gas. Soviet gas, however, represents only about 3-9 percent of total energy needs in most West European countries. 25X1

Natural gas currently provides only 7 percent of total Japanese energy use. The Japanese government expects this share to expand to about 10-12 percent by 1990. With only a small amount of domestic gas production, Tokyo relies heavily on imports in the form of liquefied natural gas (LNG). In 1983, for example, LNG imports accounted for 94 percent of Japan's consumption of 28 bcm. Imports of LNG for the first half of 1984 were running at an annual rate of about 34 bcm, pointing to a possible 30 percent increase over last year's volume. Nearly half of LNG imports come from Indonesia, with Brunei, Abu Dhabi, Malaysia and Alaska providing the remainder. By 1990, Australia will probably provide about 17 percent of LNG imports. 25X1

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Forecasting Gas Demand and Supply

Great uncertainty surrounds long-term energy demand and supply forecasts. The success of past long-term forecasts has been minimal, and recent projections remain vulnerable to the shortcomings of past projections. The threat of unexpected supply disruptions and uncertainties regarding economic growth, price trends, and the responsiveness of supply and demand to price changes all hinder forecasting. Moreover, small changes in economic growth and price can cause substantial modifications in projected energy requirements. In addition some analysts believe sharp declines in energy and gas requirements in recent years have caused forecasters to become overly pessimistic about future demand. 25X1

To assess gas market conditions through the remainder of the century, we examined several long-term forecasts completed

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West European Gas: 1983 Production, Consumption, and Imports[1]
(billions of cubic meters)

Country	Production	Consumption	Gross Imports: Total	Gross Imports: Percent Total Consumption	Gross Imports: Source	Gross Imports: Percent Total Imports
Austria	1.1	4.3	3.0	70	USSR	100
Belgium	—	9.1	9.2	100	Netherlands	61
					Norway	22
					Algeria	17
Finland	—	0.7	0.7	100	USSR	100
France	6.8	27.6	22.4	81	Netherlands	33
					Norway	9
					USSR	18
					Algeria	40
Ireland	2.1	2.1	—	--		
Italy	12.3	25.1	14.5	58	Netherlands	37
					USSR	48
					Algeria	15
Netherlands[2]	68.3	35.9	3.0	8	Norway	100
Norway[2]	21.7	—	—	—		
Spain	Negl	2.6	2.4	92	Algeria	62
					Libya	38
Switzerland	—	1.0	0.5	50	Netherlands	100
Turkey	Negl	Negl				
UK	34.0	48.1	12.9	27	Norway	100
West Germany	14.7	43.1	31.6	73	Netherlands	52
					Norway	16
					USSR	32
Yugoslavia	1.9	4.3	2.0	46	USSR	100
Total	162.9	203.9	102.2		Netherlands	35
					Norway	24
					USSR	26
					Algeria	14
					Libya	1

[1]Consumption minus production may not equal imports, becaue of lesses in production and transmission, exports and reexports, and/or storage programs.

[2]Net exporter

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recently. Our survey included forecasts by major oil companies and governments. We examined the forecasts for reasonableness of assumptions concerning economic growth and energy prices. In deriving our summary demand case we attempted to represent the consensus opinion, tempered by our own judgments. These supply/demand projections assume real oil prices decline through 1990, remain constant in real terms to 1995, and rise thereafter at 2 percent per year through the year 2000. In general, the price of other fuels, including gas, is expected to move in line with oil prices. West European and Japanese economic growth are projected at average annual rates of 2.0 to 2.5 percent, and slightly over 4 percent, respectively, through the end of the century. 25X1

* *

Natural Gas Demand Outlook

Natural gas demand is projected to increase only slowly during the remainder of this century according to industry and government forecasts.

- o West European gas use will grow by about 1-2 percent per year, rising to 250 bcm in 1990 and about 285 bcm in the year 2000. This compares with about a 10 percent annual growth rate during the 1970s.

- o Japanese gas demand is expected to increase to about 52 bcm by 1990, an 85 percent increase compared to current levels. During the 1990s, however, growth is expected to slow significantly and demand is projected to increase only an additional 10 bcm by the year 2000.

This forecast in effect constitutes our demand projection for the purposes of this paper. Most of the future growth in gas consumption is expected to occur in the residential/commercial and industrial sectors, rather than in electricity generation. 25X1

This demand estimate might turn out to be too low. Over the last decade, projections of gas demand have gone through a cycle of optimism and pessimism. In the early 1980s, official gas demand forecasts projected fairly rapid increases, reflecting the trend of the 1970s when gas had been priced significantly below alternative fuels and consequently was being substituted in a number of uses. These high demand projections and concern over dwindling domestic supplies were a major reason for the sense of urgency in West European negotiations with the USSR for the purchase of gas from Siberia. In the course of the negotiations, however, West European gas demand began to fall.

- o Economic recession triggered a reduction in energy use.

- o As a result of price indexation and attempts to achieve parity with competing fuels, gas prices rose following the

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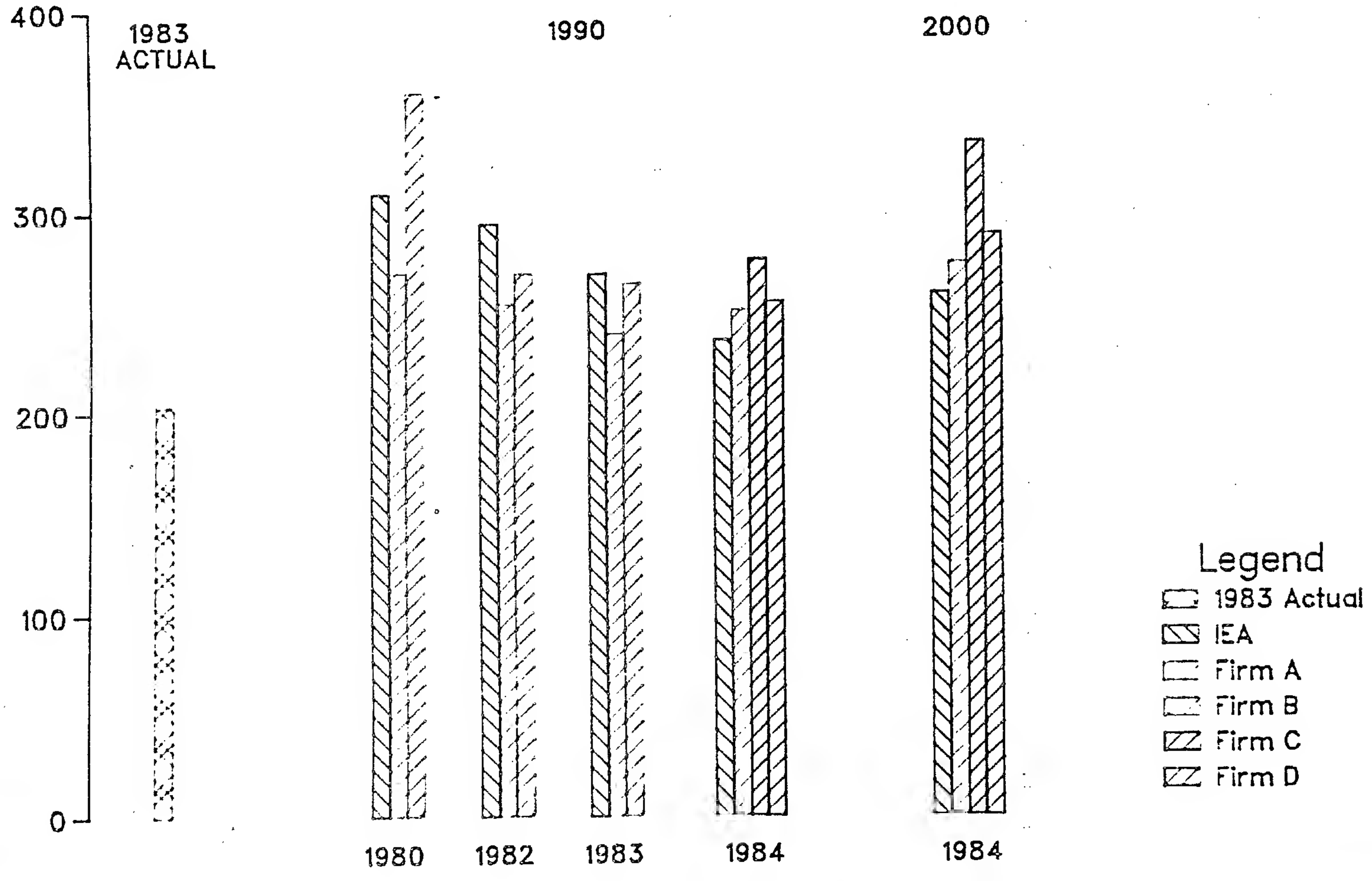
Changing Projections of West European Gas Demand, 1990 and 2000
(billions of cubic meters)



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substantial oil price increases of the 1970s and early 1980s. [redacted] 25X1

It took almost two years for official forecasts to catch up with market realities. By 1984, however, projections for West European gas demand in 1990 had been reduced by as much as 30 percent compared to forecasts made just 4 years ago and official Japanese government projections have been reduced by 20 percent. [redacted] 25X1

Despite an apparent return to the stronger growth levels of the past, recent forecasts continue to be influenced by the earlier downward trend in gas demand and pessimistic views of the prospects for economic recovery in Western Europe. Just as earlier projections overstated requirements, we believe current forecasts may be understating future growth, especially if the energy price projections built into these estimates prove to be unrealistically high. Oil prices have fallen recently, and continued weakness will restrain increases in gas prices or even cause a further decline. As a result, gas suppliers recently have already demonstrated considerable price flexibility in an attempt to increase market penetration and remain competitive with oil and other fuels. [redacted] 25X1

Meeting Demand Requirements in Europe

We believe surplus natural gas supplies worldwide will probably persist for some time. Although gas demand is expected to grow, the increase in gas use in Western Europe and Japan during the remainder of this decade can be met through existing supply commitments. Beyond 1990, however, new sources of supply will be needed to cover demand requirements. We believe import requirements are likely to grow in Western Europe. Under these circumstances, as much as 48-57 bcm per year of additional imports would need to be contracted for in order to meet European demand requirements. [redacted] 25X1

Indigenous production is expected to increase slightly between now and 1990, but will probably decline significantly between 1990-2000. Developments in three countries will play a key role in determining the amount of indigenous West European gas production available to help meet demand requirements. [redacted] 25X1

- Dutch gas production and export policy has been in a state of flux in recent years. As late as 1983, The Hague intended to completely phase out gas exports by the year 2000 in order to conserve gas resources for domestic use. According to Embassy and press reporting, however, the Dutch have recently authorized additional export commitments and have been flexible on price in an attempt to maintain market share. Although negotiations are continuing, The Hague may be willing to make available 20-30 bcm per year for export in the 1990s. 25X1

[redacted] 25X1

Major Pipelines Supplying Western Europe

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- Norwegian production and exports will depend in large part on whether Oslo can sell gas from the Sleipner and Troll fields. Statoil, the Norwegian state oil company, and the British Gas Corporation have been negotiating a contract for the purchase of Sleipner gas for the last two years, but revisions required by London, according to Embassy reporting, have so far prevented a final agreement. Most press reports suggest that negotiations to sell Troll gas may not begin until after the Sleipner sale is completed, although some industry sources believe Oslo may begin to test the European market as early as next year.

- Estimates of indigenous production in the United Kingdom vary considerably and are contributing to the delay in signing a contract for the purchase of Sleipner gas. Several energy companies believe that the UK has sufficient domestic gas supplies to meet demand to at least 2000, while British Gas Corporation and the UK Offshore Operators' Association are urging the UK to line up additional future gas supplies. 25X1

Because of the potential wide variation in future domestic West European natural gas production and the different possible approaches for covering a supply shortfall, we have developed three illustrative scenarios that delineate the range of options available to Western Europe. All three scenarios utilize the consensus gas demand forecast developed from our review of government and industry demand projections. The scenarios differ, however, in the amount of anticipated indigenous production, and consequently, in the level of projected imports. The first scenario projects high levels of indigenous production with the result that no further purchases of Soviet gas are required to meet Western European gas demand in either 1990 or 2000. The second scenario is much more pessimistic on estimated indigenous production, and projects a substantial supply gap in the late 1990s, all of which is filled by additional imports of Soviet gas. The third scenario offers a moderate level of indigenous production, and suggests that some, but not all, of future gas requirements in Western Europe will be met by increased Soviet gas purchases. 25X1

While we have not varied demand estimates across scenarios, it should be noted that the size of future potential gas surplus or deficits could also vary substantially as a result of changes in demand. Given the historic relationship between economic activity and energy consumption, we estimate that a one-percentage point increase in OECD economic growth will raise energy demand by a comparable amount. If improved economic growth were maintained--one-percentage point higher economic growth in every year for the remainder of the decade--1990 energy demand could be increased by more than 6 percent. If demand for natural gas increased at the same rate as total energy, 1990 West European gas requirements could increase by about 15 bcm. 25X1

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Case I -- Maximum Indigenous Development

In this scenario no further market develops for additional Soviet gas sales. Indeed, Western Europe would have surplus indigenous gas throughout the period. A number of optimistic assumptions underlie this scenario.

- o UK domestic gas production capacity reaches a high level of about 60 bcm.
- o UK contracts for Norwegian Sleipner gas, which makes the UK a potential net exporter after 1990.
- o Continued high levels of Dutch exports of 35 bcm in 1990 and about 20 bcm in 2000.
- o Contracted output of 30 bcm from Norway's Troll field by the year 2000.

Due to these favorable assumptions and the resulting gas surplus, a UK-to-Continent pipeline might be considered for the purpose of reexporting competitively priced gas from Europe to displace alternative Soviet supplies, in the event of a supply disruption or increased continental gas demand. 25X1

We consider this scenario overly optimistic because of the large number of favorable developments required to achieve maximum development of indigenous resources. For Sleipner gas to be delivered to the UK as assumed in this case, contract terms would have to be determined soon in order for construction to proceed. Similarly, given a minimum 10-year lead time for contract negotiations and development of Troll, negotiations for this gas must begin within the next year or so. Furthermore, successful conclusion of Troll negotiations will, in large part, depend on the price competitiveness of the gas which may require tax concessions from Oslo. For this case to be realized, moreover, the Netherlands must decide to maintain substantial gas exports. 25X1

Case II -- Minimum Indigenous Development

In this scenario, a West European supply surplus in 1990 is replaced by a supply shortfall of about 48 to 57 bcm by the year 2000. This volume is assumed to be covered fully by additional Soviet deliveries giving Moscow about 40 percent of West European gas sales in the year 2000. Assumptions underlying this case include:

- o A domestic production profile for the UK of about 40-44 bcm, at the lower end of the range projected by industry sources.
- o Norway continues to sell only previously contracted gas, with neither Sleipner nor Troll developed.

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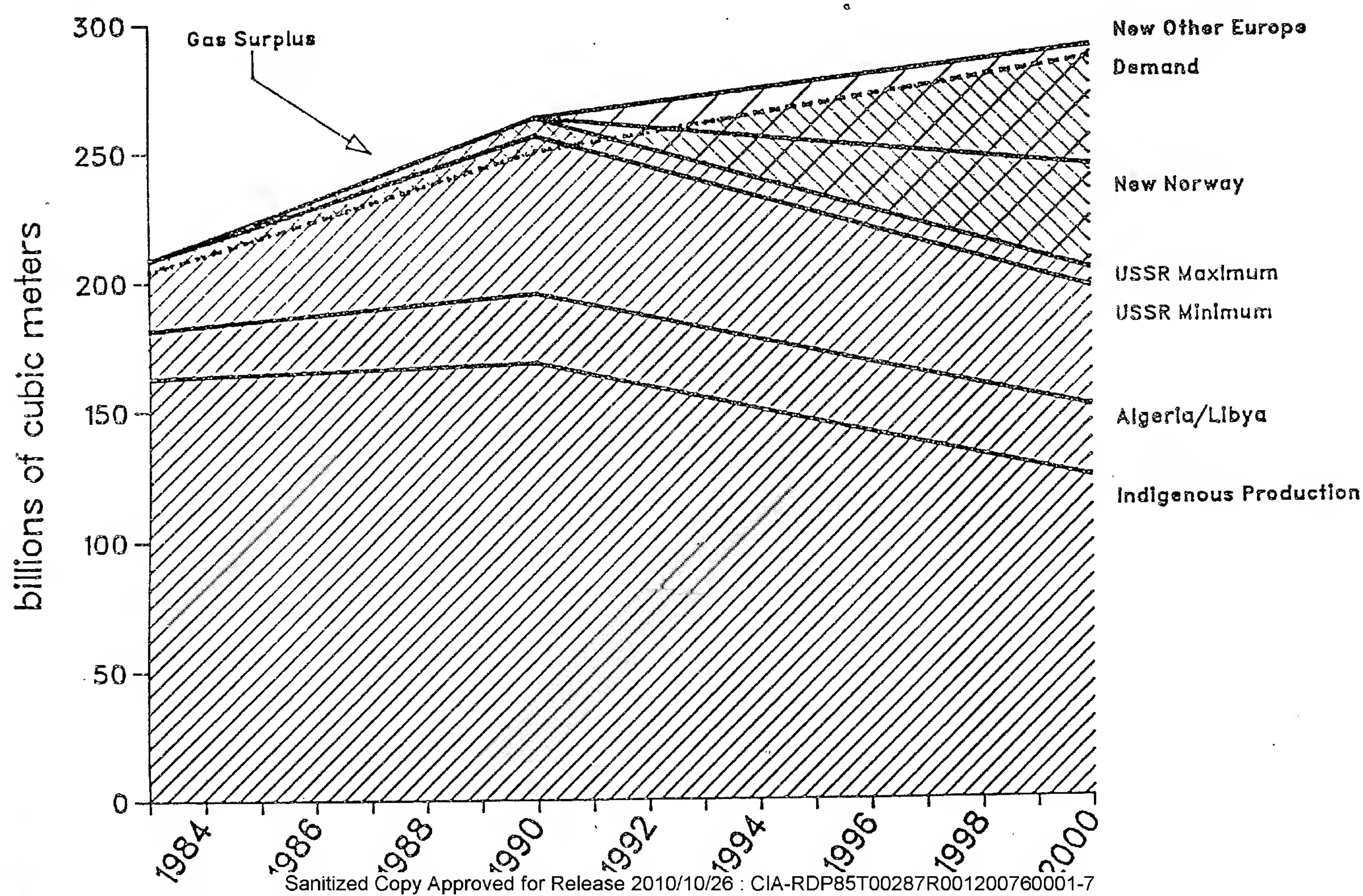
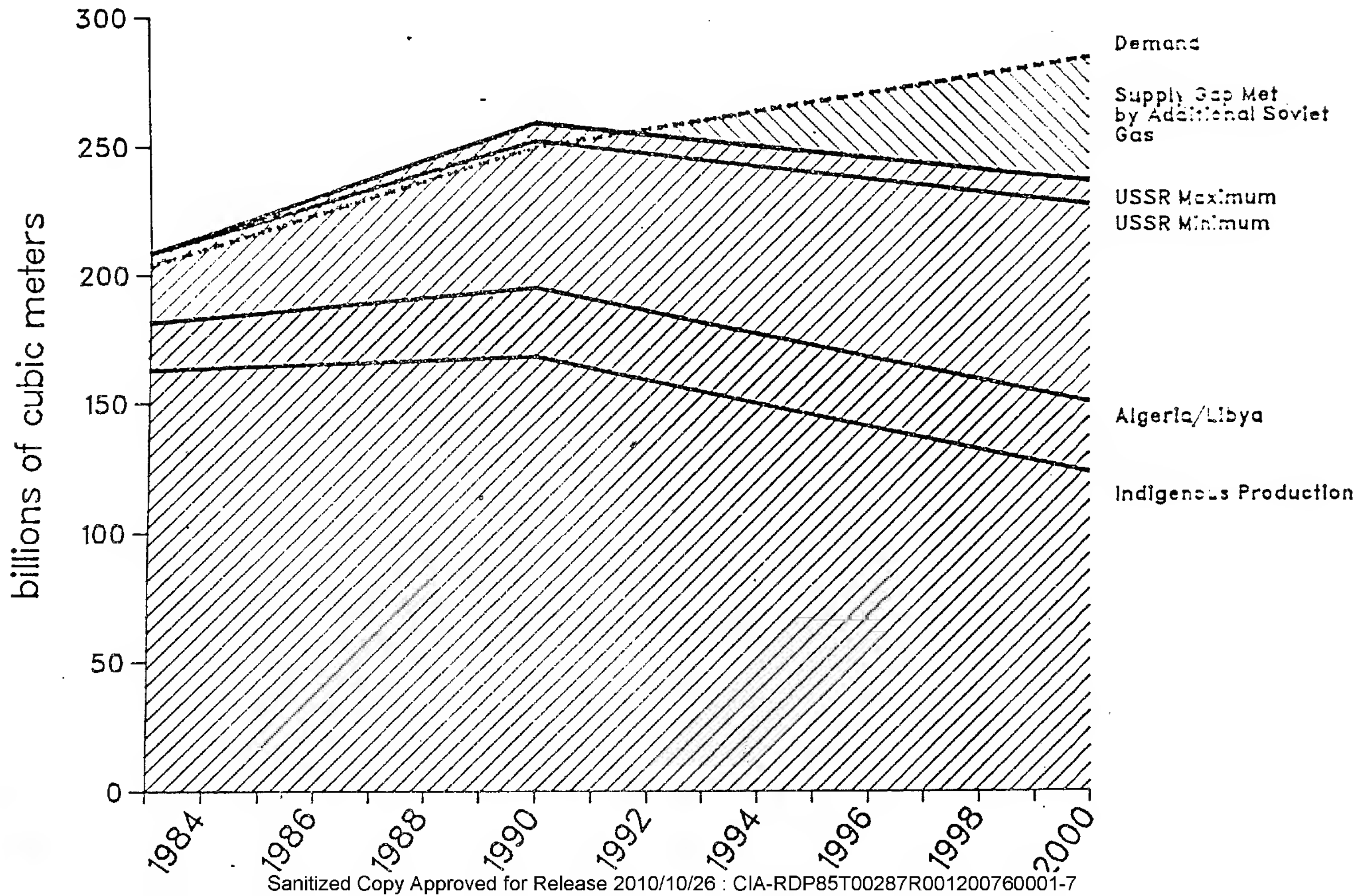
Western Europe: Natural Gas Supply and Demand, 1983–2000
Case I: Maximum Indigenous Development



Western Europe: Natural Gas Supply and Demand, 1983–2000
Case II: Minimum Indigenous Development



 [redacted] 25X1

- The Dutch completely phase out exports by 2000. [redacted] 25X1

While we consider this case overly pessimistic, it cannot be ruled out. Protracted discussions with little progress could postpone the development of Sleipner and Troll. Moreover, declining energy prices and uncompetitive gas price demands could further delay the development of Troll if expected earnings are insufficient to justify the large capital outlays required. A Continent-to-UK pipeline might also be considered under these conditions primarily for the purpose of bringing Dutch or other gas to the UK. This connection in turn would open the UK market to Soviet penetration. [redacted] 25X1

Case III - Moderate Indigenous Development

In this scenario, Western Europe again faces a gas surplus in 1990, but will need to contract for an additional 8 to 15 bcm of gas by 2000. Our assumptions include the following:

- Moderate UK domestic gas production from 40 to 50 bcm.

- As in the first scenario, the UK contracts for Norwegian Sleipner gas, which satisfies UK demand requirements.

- Norway supplies 15 bcm of Troll gas by 2000, or half the volume assumed in the first scenario.

- The Netherlands continues to export 20-30 bcm in the 1990s.

- The UK and European gas markets remain separate, with no pipeline link under consideration.

The Soviets could cover the shortfall in this scenario at low marginal cost, at first by using surplus capacity in existing pipelines. [redacted] 25X1

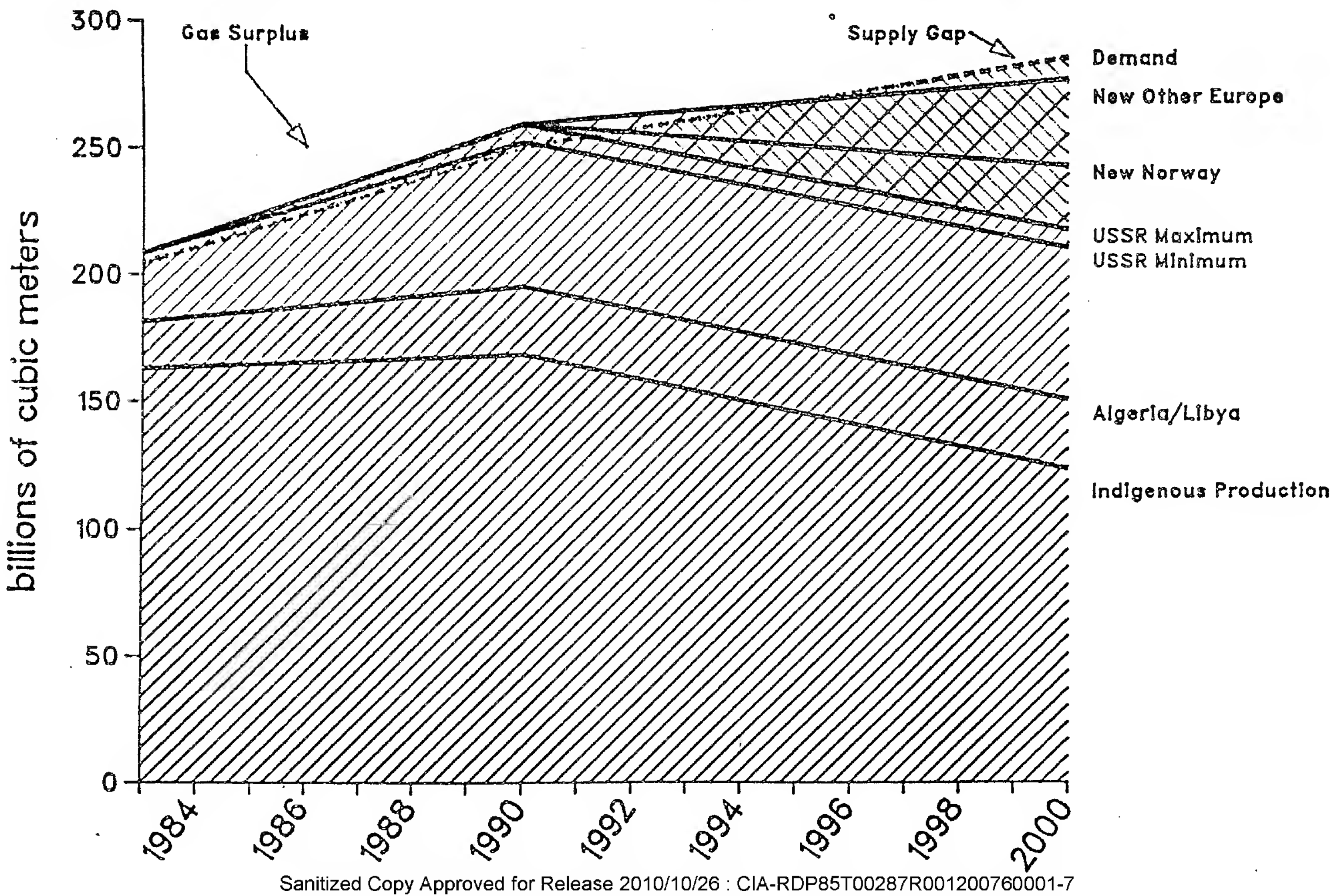
Meeting Japanese Requirements

Although Japan does produce some domestic gas, the lack of significant reserves will cause Tokyo to remain almost completely dependent on imports. Even increased offshore drilling is expected to boost domestic production to only 5-10 percent of domestic requirements by the end of the century. [redacted] 25X1

Japanese import requirements through the early 1990s will be more than satisfied if all projects now agreed to or under construction are completed as scheduled. Despite the low growth in LNG requirements from 1990 to 2000, Japan will need to contract for additional supplies. In addition to a 9 bcm growth in demand, existing agreements with Brunei and Abu Dhabi will expire in 1993 and 1997, respectively. Even so, published Japanese documents indicate Tokyo has already contracted for over half of its estimated demand in 2000, if Australian LNG is

[redacted] 25X1

Western Europe: Natural Gas Supply and Demand, 1983–2000
Case III: Moderate Indigenous Development



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included. If the Abu Dhabi and Brunei contracts are renewed in similar volumes, as seems likely, Japan will have provided for nearly 70 percent of anticipated needs. [redacted] 25X1

Given the many LNG projects under consideration, Japan has great flexibility in choosing its future gas suppliers and does not now seem to be concerned with possible delays in development projects.

- The proposed Sakhalin LNG export project continues to experience delays and consumers have so far been reluctant to guarantee purchases. Japanese construction firms, however, remain eager to win contracts associated with the development of this Soviet gas.

- Japan signed a letter of intent in 1981 to participate in Australia's LNG project. Plans have moved forward rapidly in the past year with purchase contracts likely to be signed in the near future. Shipments are targeted to begin in late 1989.

- In Canada, the Western LNG project is stalled by Dome Petroleum's financial problems-- largely caused by Japan's Chubu power company's refusal to make a commitment to the project. The project could be cancelled if attempts to reorganize equity participation in the venture are unsuccessful.

In addition to these three projects, several other LNG projects are currently under study.

- In Thailand, a Thai-Japanese LNG venture recently won Bangkok's approval, and work will soon begin on a two-year feasibility study. According to public reports, the project is believed to face many obstacles, the most serious of which is the possibility of an LNG supply glut in Japan.
- Already the world's largest exporter of LNG, Indonesia has granted Japan an option to purchase an additional 8.5 bcm.

- The project to develop 8.5 bcm of LNG in Qatar has been repeatedly shelved and revived. To date no Japanese or other foreign buyers have contracted for future supplies.

- A prefeasibility study on a proposal to develop about 20 bcm per year of Alaskan North Slope gas for export to Japan is currently underway. A smaller Alaskan export project of about 2.1 bcm is also under consideration, according to the trade press.

Given the large number of potential suppliers, Tokyo can easily meet its future LNG requirements without Sakhalin gas. We believe the Japanese may nevertheless decide to purchase Soviet

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 [redacted] 25X1

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gas to diversify away from its traditional suppliers if it can obtain a relatively low price, or to obtain equipment orders. [redacted]

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A Soviet Perspective on Natural Gas Sales to Western Europe

A recent article in a Soviet foreign trade journal contains Moscow's perceptions of West European gas demand, supply, and imports in the year 2000. West European demand for gas imports, according to the Soviet article, will be met in part by increased capacity and throughput on the Trans-Mediterranean pipeline from Algeria to Italy and possible deliveries through an as yet unconstructed gas pipeline from Algeria to Spain. Even with these somewhat speculative additions to capacity and supply, the article sees a shortfall in European supplies of from 70 to 80 bcm in 2000. While the author does not indicate what fraction of this shortfall will be met by the combined deliveries of Dutch and Norwegian gas, he points out that appreciable quantities of Soviet gas could find a ready market in Western Europe. [redacted] 25X1

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Soviet Marketing Strategy and Successes

Soviet marketing strategy is designed to capture new or incremental Western demand for natural gas in order to help meet hard currency revenue needs. Moscow's pricing policies have been pragmatic and flexible, allowing it to adapt to market fluctuations to achieve its goals. In our view, recent Soviet marketing efforts could also undermine the development of alternative gas projects, leaving Moscow well placed to meet additional West European import requirements in the 1990s. [redacted] 25X1

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We expect the Soviets to continue to market their gas aggressively in the West, undercutting competitors' prices when necessary. Because of low production costs for Siberian gas and the Soviet's capability to expand their pipeline system, Moscow will be able to offer additional gas at low prices if it chooses to do so. [redacted] 25X1 in recent negotiations, the Soviets have even agreed in principle to deliver gas to some new customers below the price of fuel oil--the main competitor with gas. With spare capacity in existing lines, Moscow could use these pricing tactics to capture incremental growth in West European import demand and limit access of potential suppliers to the European market. Additional Soviet sales, for example, could undercut sufficiently the volume of new gas supplies needed from the Norwegian Troll field and make its development uneconomic in the next decade. [redacted] 25X1

[redacted] 25X1

Moscow also has proven to be quite adept at tying sales to goods and equipment purchases to put further pressure on the West Europeans and Japanese to import Soviet gas. The possibility for large-scale, Soviet coal-slurry pipelines in the 1990s--each of which would reportedly involve an investment comparable to that required for the Siberia-to-Western Europe natural gas pipeline--could lure the West Europeans to purchase Soviet gas in exchange for lucrative Soviet equipment contracts. In our judgment, Japanese interest in Soviet energy projects is based principally on a desire to sell equipment. 25X1

So far this year Moscow has concluded three new gas export agreements with Finland, Italy, and Austria, and an agreement in principle with Turkey. In each instance, Moscow has shown willingness to market natural gas at prices competitive with other fuels, and has been receptive to bilateral trade proposals or to proposed purchases of goods from the gas consuming countries. 25X1

- Finland agreed early in 1984 to increase its purchases of Soviet gas from the current level of about 0.7 bcm to over 2.5 bcm by the end of the century. Helsinki has been under pressure from Moscow to buy more gas to help reduce Finland's growing surplus on the bilateral trade account. 25X1

- Italy agreed in May of this year to purchase an additional 4.4 - 4.5 soviet gas amounting in 1990 and from 4.8 - 6.0 bcm in 2000, at a price of about $3.60 per million Btu. This price is the lowest yet granted to any purchaser of Soviet gas since the 1979-1980 oil price hikes. At the same time the gas sales agreement was concluded, another agreement was signed obligating the Soviets in principle to increase imports of Italian machinery, including compressor station equipment, and consumer goods. 25X1 25X1

- This past summer Austria also signed a new gas supply contract with the USSR. At the same time, Austria also announced a new agreement with the Soviets on the delivery of oil field pipe to the USSR. Such deliveries, begun in 1969, are linked to Soviet counter-deliveries of natural gas. According to published reports, Austria has flatly rejected the possibility of diversifying gas imports, arguing that Soviet gas holds a 30 percent price advantage over North Sea gas. 25X1

- The USSR also concluded in September 1984 a 25-year agreement in principle with Turkey. This agreement calls for the export of up to 1.5 bcm of Soviet gas in 1987, rising to 6.0 bcm in 1990. Moscow has agreed to deliver the gas at less than the price of fuel oil, with payment in as-yet unspecified Turkish goods. 25X1

Further Soviet Efforts

Moscow has also stepped up gas marketing efforts in other countries as well. Currently, Greece is conducting a feasibility study to decide whether to import up to 2 bcm of Soviet gas. The decision could be influenced by the Turkish-Soviet agreement, since the same pipeline through Romania and Bulgaria could be used to supply both Greece and Turkey. Should Greece decide in favor of Soviet gas imports, these might begin before 1990. According to Embassy reporting, Greek firms hope to win some of the construction contracts associated with the new gas pipeline system, and Greece may pay for the gas with aluminum products from a new plant. An extension of the Soviet pipeline network into Turkey or Greece could effectively block access to the West European market by suppliers in the Middle East. Markets in Turkey and Greece are key stepping stones for Middle Eastern suppliers because they will need to sell gas in transit to minimize the cost of delivery. Moreover, the cost of shipping LNG to Western Europe from the Middle East would be more than 30 percent more expensive than pipeline shipments [redacted] 25X1 25X1

Another West European country where the USSR has tried to develop a new market is Sweden. To date, Sweden has not been persuaded to import Soviet gas. In October, Swedegas, Sweden's state natural gas supplier, concluded that the proposed project to deliver 1 bcm of Soviet gas via Finland by 1988 was not economically feasible. Swedegas also noted the reluctance of Swedish industrial customers to become dependent on the Soviet Union as sole supplier, according to Embassy reporting. [redacted] 25X1 25X1

The flexibility in gas pricing and trading terms shown so far is indicative of the Soviet determination to meet incremental gas demand and increase gas sales to the West. Recent price competition from the Soviets is forcing the Dutch to reevaluate their price terms with their European customers. [redacted] 25X1

Alternatives to Soviet Gas

We believe that competitive Soviet pricing policies could forestall development of more secure alternatives as West European demand recovers. Alternative gas sources are available, but unless decisions to proceed with development are made soon, these gas supplies will not be forthcoming when existing supply contracts begin to expire after 1992. Moreover, the cost of these new gas supplies will be high. [redacted] 25X1

- o With more than one-third of Western Europe's total proved gas reserves, Norway could supply an additional 40 bcm in the 1990s. Development of West Troll has been declared commercial by Norske Shell based on a $6 billion

[redacted] 25X1

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development plan that would make the project about 1.5 times more expensive per unit of capacity than any other offshore development project. Total development costs could approximate $30 billion, according to some industry sources. Because of the Troll Field's long development leadtime--at least 10 years--a contract would have to be signed soon if the field is to start production by the mid-1990s. Compared with a current price of about $3.60 to $4.00 per million Btu for imported gas supplies in Western Europe, the cost of delivering Norwegian gas from the Troll Field is placed at $5.50 to $8.50 per million Btu by Norwegian Government sources. 25X1

- Additional gas fields have been discovered off Northern Norway, including Troms, Askeladden, and the Haltenbanken fields. All of these could provide substantial additional volumes of gas. 25X1 the costs associated with deepwater offshore development, difficult pipeline routes to shore, and liquefaction facilities may make these projects uneconomic until after the turn of the century, given the existing tax structure and expectations of future gas prices. 25X1

- The cost of new gas supplies from the Middle East or Africa could be even higher. Capital costs for a large-scale, 15- to 20-bcm LNG project could approximate $15-20 billion. Long-distance gas pipelines from the Middle East or Africa, moreover, could pose security problems and leadtimes for these projects could be up to 10 years. 25X1 25X1

Given the likelihood of continued softness in world energy markets, we believe new gas export projects will be difficult to justify on near-term commercial or even regional economic grounds.

Contingency Planning

Because of concerns about the level of dependence on Soviet gas supplies, increased storage facilities probably need to be constructed. As a result, the cost of building and operating gas storage facilities can serve to narrow the price difference between relatively inexpensive Soviet gas and new non-Soviet supplies. While there is little evidence to date on historical or proposed costs, the expense of developing storage facilities can vary quite significantly. A West German estimate from 1981 gives the capital cost of storage in an abandoned gas field at $0.27 per cubic meter in 1981 prices. In the absence of a suitable gas field, cost can increase to almost prohibitive levels. A West German estimate of 1977 places the capital cost alone of gas storage in non-gas field areas at about $33 per cubic meter in 1977 prices. The high cost estimate reflects the preparation of new underground gas storage caverns. In the future, new storage facilities involving high capital costs are

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likely to be needed, because in our view, sufficient old or abandoned gas fields are not likely to be available to provide needed capacity. 25X1

In addition to raising capital costs, the increased use of gas storage also raises operating costs. A 1983 Dutch estimate suggests that the operating cost per million Btu to remove gas from storage ranges between $0.08 and $0.25. In addition, the transport of this gas to end-users leads to an increase of about $0.02 per million Btu in distribution costs. None of these calculations includes the cost of gas used as fill for the storage facility or the fact that not all gas stored may be ultimately recoverable when needed. Additional contingency planning for potential natural gas supply disruptions, beyond planned gas storage, is required in all West European gas consuming countries. These plans should provide for interruptible gas contracts, local surge production capacity, and flexibility in supply contracts, to be used separately or together in the event of an interruption in gas flows. Currently, there are large variations in planning between countries, and in many cases plans are designed to deal with accidental, technical or seasonal swings in demand, rather than deliberate interruptions in supply. 25X1

Detailed simulations of the West European gas distribution system that we conducted suggest that the integrated gas network can meet most of the demand arising from a gas disruption under existing supply arrangements. Effective use of the physical distribution system during a disruption, however, will require a degree of regional planning and cooperation that will be difficult to achieve. The problems would obviously be compounded if the level of dependence on Soviet gas were higher than current contracts indicate. 25X1

Under present gas distribution policies, any Soviet gas embargo during the peak winter months could cause minor gas shortages in certain areas even though the physical distribution system would otherwise be adequate. Even under favorable circumstances, including extensive regional planning and cooperation, a simultaneous Soviet and Algerian embargo lasting six months--in which Algeria might seek economic leverage from Soviet action--would severely strain the West European gas network by the end of the decade. Such an embargo would require peak production from all domestic sources, including the Netherlands. At the end of a joint Soviet-Algerian embargo lasting 12 months, storage would be severely depleted, leaving Europe extremely vulnerable to any additional supply problems. Comprehensive regional planning and cooperation could alleviate some of the effects of such major supply disruptions. Moreover, we believe awareness of such planning might discourage gas exporters from even attempting an embargo. Until West European governments view gas supply availability in a regional strategic perspective, the coordination necessary to use effectively Europe's gas system during a disruption is highly unlikely.

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Implementations of current national West European gas supply emergency plans--which vary widely in scope and depth--could even aggravate shortages in other countries during a major disruption. 25X1

Energy Security Implications

According to our analysis, surplus gas supplies and gas distribution flexibility in Western Europe and Japan probably will be sufficient to handle even a major gas supply disruption during the remainder of the decade. The surplus of gas during the 1980s, together with Soviet marketing efforts, however, could prevent or delay development of new projects needed to meet West European demand requirements in the 1990s. Failure to develop new gas supplies could leave the major industrialized countries more heavily dependent upon Middle East oil or allow the Soviet Union to capture a greater share of West European gas markets in the 1990s. Moreover, delays in developing alternative LNG projects for the Japanese market could bode well for Soviet efforts to sell gas from the Sakhalin LNG export project. 25X1
25X1

Western Europe must decide within the next few years how it will meet its natural gas requirements in the 1990s. Although there are a number of new indigenous gas fields which could help satisfy European demand to the end of the century, it is uncertain whether gas produced from these structures could be competitive with Soviet supplies under current tax structures. Tax reform or reduction of the tax burden for high-cost projects would narrow the potential price differential, and serve as an incentive for firms to proceed with development. Alternatively, a price acceptable to buyers could be agreed upon and an individual tax structure for the project set up to allow production at the agreed price. Even if the Norwegians changed their position against government tax concessions or subsidies, however, we believe the West Europeans probably would have to make a political commitment to ensure development of Troll by paying a premium for security of gas supplies. 25X1

At the same time, the estimated price differential between new indigenous gas supplies and future Soviet gas sales will be overstated if it fails to incorporate the cost of increased storage capacity required for security reasons. Even with both a reduced tax take and Soviet gas prices escalated to include required storage costs, Soviet gas may still appear less costly than alternative sources. The size of this differential will be the premium required for new and secure indigenous gas supplies. 25X1

Western Perspective on Soviet Trade

Whether the West decides to maximize development of its indigenous resource base or to purchase increasing amounts of Soviet energy will, in large part, depend on how vulnerable they

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perceive themselves to be. This perception will be shaped not only by the degree of energy dependence and the cost of alternative supplies, but also by general trade issues and expected benefits from increased East-West cooperation.

West European Attitudes

The West Europeans do not regard their present or projected energy dependence on the USSR as a serious problem. On the contrary, they believe that their overall energy security actually is enhanced by this diversification of energy sources away from OPEC. They argue that the Soviets have proven to be reliable and businesslike trade partners who would be extremely reluctant to disrupt a relationship from which they derive great benefit. In our view, this assessment is basically valid -- so far at least. The USSR has in fact established a good record of honoring contracts and there have been very few instances of it using economic leverage in an effort to get political concessions from Western Europe -- the most notable exception occurring in 1958 when Moscow cut purchases from Finland in a successful bid to force the exclusion of Conservatives from the Finnish cabinet.. A recent report that Moscow had threatened Austria with economic reprisals if it tightened controls on technology transfer apparently was unfounded, and a Soviet official apparently was speaking out of turn when he said that energy deliveries to the United Kingdom would be cut off in support of the miners' strike. 25X1

To be sure, West European policymakers are not totally sanguine about the growing dependence on Soviet energy. Both France and West Germany decided several years ago that Soviet gas should not supply more than about 30 percent of their total gas needs[1] -- a level that they, along with Italy, will reach by the end of the decade when the new Soviet pipeline is in full operation. At this level of dependence a Soviet gas embargo would create difficulties, but the West Europeans are confident that they could cope reasonably well by means of conservation, fuel-switching, and increased imports of Dutch gas. 25X1

With the West Europeans now seeking additional gas supplies to cover their needs in the 1990s, the key question is how they would feel about still greater dependence on the USSR. Another major deal with Moscow would push the Soviet share of the gas market close to 50 percent in the major recipient countries, obviously increasing the vulnerability to a cutoff. To avoid this situation we believe the West European gas buyers will first try to negotiate a deal for Norwegian gas and will even be willing to pay a small premium for gas from such a secure source. If Oslo is too demanding on price, however, we think the

[1]Paris recently restated this policy in somewhat different form: that no single gas supplier should provide more than 5 percent of France's total energy needs.

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gas-buying countries would have relatively few qualms about turning to the USSR and would have little difficulty in reconciling this step with their IEA commitment to avoid undue dependency on a single supplier. 25X1

The United States probably does not have much leverage to influence the West Europeans on this issue, which they regard as primarily an internal matter. In our view the single most important element in forestalling another Soviet gas deal will be Oslo's willingness to lower its gas revenue demands enough to make gas from the Troll field competitive in Western Europe. As a third party to the negotiations, the US might have some capacity to influence Norwegian thinking on this. Additional US arguments about the dangers of dependency on the USSR probably will not get far with the gas buyers, who will stress that this is something for them to decide. Arguments about the benefits to the Soviet military of additional hard currency earnings would make only slightly more headway. The West Europeans would counter by stressing their opposition to "economic warfare" and by arguing that, if more generalized economic pressure is to be used against the USSR, then grain sales restrictions should also be part of the arsenal. 25X1

<u>Attitude Toward Soviet Trade in General</u>. In probably every West European country the prevailing view on trade with the Soviet Union is that it is desirable on both political and economic grounds. To be sure, estimates of the political benefits have been scaled back sharply compared with a decade ago, when many West Europeans believed that expanding trade would lay the foundation for a lasting improvement in East-West relations. These hopes were dashed when the rapid growth of Soviet-West European trade during the 1970s was followed by new Soviet missile deployments, the invasion of Afghanistan, and repression in Poland. Nonetheless, West European attitudes have only been modified, not fundamentally altered; the standard argument, in effect, is that Soviet behavior is better than it would have been in the absence of trade. A French official probably captured the prevailing view on the continent when he said that without trade, Moscow would look on Western Europe purely in military terms. 25X1

The economic benefits of trade with the USSR are more tangible but are still modest -- and, in our view, tend to be exaggerated by the West Europeans. The basic reality is that a market that accounts for only about 2 percent of Western Europe's exports cannot have a major economic impact on the region as a whole. In terms of employment, a West German economics institute has estimated that 122,000 West German jobs were directly or indirectly dependent on exports to the USSR in 1982. Since West Germany accounts for more than 40 percent of total West European sales to the Soviet Union, the jobs figure for the whole continent probably is on the order of 300,000--roughly 0.3 percent of the labor force. 25X1

25X1

The exaggerated importance attached to the Soviet market probably is a reflection of the nature of the trade. Deals with the Soviet Union typically are large-scale affairs, as opposed to a series of small contracts, and thus garner a disproportionate share of publicity. Perhaps even more important, most Soviet orders go to industries that have been depressed in recent years and that have powerful labor unions to help argue their cause. The struggling West European steel industry is the most obvious example: about 8 percent of its exports last year went to the USSR. 25X1

The West Europeans also see one major benefit on the import side of their trade with the Soviet Union: reduced dependence on OPEC. Four-fifths of their purchases from the USSR now consist of energy products and these covered about 8 percent of Western Europe's total energy needs in 1983. Without the Soviet oil and gas Western Europe would have to depend much more heavily on OPEC, which currently supplies about 23 percent of its energy needs. 25X1

Export Controls. Over the years there has been little change in the West European belief that export controls are justified only for products that contribute directly to Soviet military capabilities--and they tend to take a narrower view in defining such products than does the United States. The underlying attitude is that more generalized economic sanctions have no significant impact because the Soviet military always gets what it needs anyway. According to this strongly held view the entire burden of generalized sanctions is borne by the Soviet civilian economy--and by the Western suppliers who have lost the sales opportunity. 25X1

We thus believe it is highly unlikely that the West Europeans will agree to any significant COCOM restrictions on the sale of oil and gas equipment to the USSR. In addition to making the points outlined above, they are likely to argue that additional Soviet oil and gas production would benefit the world economy by reducing its dependence on OPEC. The West Europeans will also be aware, of course, that a large part of any Soviet hard currency earnings resulting from additional energy production is likely to be spent in Western Europe. 25X1

On the other hand, the West Europeans have significantly tightened the terms on export credits to the USSR. Throughout the 1970s and into the early part of this decade--when large contracts for gas pipeline equipment were being negotiated--they competed with each other in a counter-productive effort to boost exports by offering favorable credit terms. As the Soviets became adept at playing one country off against another, the West Europeans gradually realized that they were net losers in this game. As a result they joined in a new OECD consensus agreement that significantly boosted interest rates on export credits to the USSR. Moreover, they appear to be adhering closely to the

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agreement, with even the French and the Italians holding out against on-going Soviet efforts to get them to break ranks. [redacted] 25X1

Japanese Attitudes

While the Soviet Union could become increasingly important as a natural gas supplier to Western Europe in the future, and will continue to aggressively market the Sakhalin project, Moscow is and will remain only a marginal energy supplier for Japan. Japanese interest in Soviet energy projects is based principally on a desire to sell equipment rather than to purchase coal, oil or natural gas.

- The Sakhalin project is stalled because the Japanese have not yet made a commitment to buy the LNG. [redacted] 25X1

- The Japanese were to receive 100 million tons of coal over 16 years from South Yakutsk, but the Soviets missed the first deadline in 1983. [redacted] 25X1 25X1 25X1

Since the oil crises of the 1970s, Japan's energy policy has been based on conservation and diversification to ensure stable supplies. Given traditional Japanese mistrust and dislike of the Soviet Union, we believe Tokyo would go to great lengths to avoid any semblance of dependence on Moscow. The Japanese may, however, purchase competitively priced Soviet LNG, coal and oil as part of their strategy to reduce energy costs and increase their sources of supply. We believe one reason Tokyo has supported energy projects worldwide--in addition to promoting equipment sales--is to increase competition among suppliers to allow Japanese firms to extract better contract terms. [redacted] 25X1

Purchases of Soviet energy products will affect Japan's primary suppliers more than the United States. The United States is only a marginal supplier of coal and LNG--goods for which other major producers generally offer lower prices. US metallurgical coal, for example, although of high quality, is priced $10-15 per ton higher than that of Japan's other suppliers. Most steam coal from the United States is also relatively expensive. Japanese users will probably not significantly increase their purchases until prices fall, [redacted] 25X6 25X6 25X1 The Japanese will buy Soviet

[redacted] 25X1

Yakutsk coal that is competitively priced, but the higher quality of US metallurgical coal will help US producers maintain market share. [redacted] 25X1

The Sakhalin LNG project is only one of many the Japanese are involved in which will compete with Alaskan natural gas development projects. All are moving slowly because Japanese LNG consumers have been unwilling to make new purchase commitments since their needs through 1995 are fully covered by existing and prospective contracts and demand is growing more slowly than originally projected. The participation of Japanese banks, trading companies and equipment manufacturers--frequently with government encouragement--does not automatically imply large purchases by Japan's nine influential power companies. But LNG consumers would no doubt like to see increased competition help them break the rigid take-or-pay clauses in their current contracts. [redacted] 25X1

[redacted] 25X1

<u>Trade.</u> There is a consensus in Japan that it is time to improve ties with the USSR, and both Prime Minister Nakasone and Foreign Minister Abe have made smoothing relations with Moscow a priority. The Japanese also want to promote economic cooperation.

- o Steel companies, some of which have a large stake in pipe sales to the Soviet Union, are just coming out of a three year depression.

- o Equipment manufacturers are reluctant to give up the expanded market shares they have developed over the past two years, especially at a time when sales seem to be leveling off. MITI would support them in efforts to avoid restraints on exports of US-licensed technology.

[redacted] 25X1

- The government would lose the $181 million dollars it had invested as of November 1984 in the Sakhalin project if the contracts are abrogated and might have to pay insurance on any funds invested by private firms. 25X1

<u>Export Controls.</u> Tokyo would probably react strongly to a US demand for further restrictions of energy equipment exports to the Soviet Union at this time and would be skeptical that all the allies could be induced to cooperate. Tokyo will probably argue that restrictions are not justified at this time--unlike after the Polish crisis or the invasion of Afghanistan. Since most of the items concerned are not COCOM controlled, Tokyo would insist upon a multilateral consensus on any sanctions by the Western allies before taking action. The Japanese felt betrayed when West European firms sold equipment to the USSR after Japan had cooperated with the United States on sanctions after the Afghan invasion. Business interests will continue to argue that energy equipment is not strategically significant, is widely available, and has been freely sold in the past. They will also maintain the United States is promoting export restrictions to further US business at the expense of foreign firms. 25X1

<u>Implications</u>

On balance, we believe that Western attitudes and Moscow's marketing strategy will lead to additional purchases of Soviet energy, particularly natural gas. Concerns over an undue dependence on Soviet imports, however, should help limit the size of additional purchases. Nevertheless, if substantial progress on the development of indigenous Western gas resources is not achieved over the next few years because of weak demand, the high price of new gas, and stringent tax structures, Soviet gas may make significant further inroads. Thus far the West Europeans have shown little indication of taking the steps necessary to prevent this outcome. 25X1

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Table 2

West Germany: Natural Gas Supply and Demand[a]

(billion cubic meters)

	1983[b]	1990	2000
Production	15	18	16
Import demand	32	35	43
Contracted Supplies	32	46-49	46-49
USSR	10	20-23	20-23
Netherlands	17	15	--
Norway	5	10	10
Denmark	--	1	1
Shortfall (surplus)	--	(11-14)	9-12

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[a]Numbers may not add to totals shown due to rounding.
[b]Actual trade.

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Table 3

France: Natural Gas Supply and Demand[a]

(billion cubic meters)

	1983[b]	1990	2000
Demand	28	35	45
Production	6	3	2
Import Demand	22	32	43
Contracted Supplies	22	24-26	24-26
USSR	4	11-13	11-13
Algeria	9	9	9
Norway	2	4	4
Netherlands	7	--	--
Shortfall (surplus)	--	6-8	17-19

[a]Numbers may not add to totals shown due to rounding.
[b]Actual trade.

 25X1

Table 4

Italy: Natural Gas Supply and Demand[a]

(billion cubic meters)

	1983[b]	1990	2000
Demand	25	36	45
Production	12	14	14
Import demand	13	22	31
Contracted Supplies	14	31-33	25-27
USSR	7	11-13	11-13
Libya	--	2	2
Algeria	2	12	12
Netherlands	5	6	--
Shortfalls (surplus)	--	(9-11)	4-6

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[a]Numbers may not add to totals shown due to rounding.
[b]Actual trade.

25X1

Table 5

Belgium: Natural Gas Supply and Demand[a]

(billion cubic meters)

	1983[b]	1990	2000
Demand	9	12	12
Production	--	--	--
Import demand	9	12	12
Contracted supplies	9	8-10	5-7
Netherlands	5	3	--
Norway	7	2	2
Algeria	2	3-5	3-5
Shortfall (surplus)	--	2-4	5-7

[a]Numbers may not add to total shown due to rounding.
[b]Actual trade.

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Table 6

United Kingdom: Natural Gas Supply and Demand[a]

(billion cubic meters)

	1983[b]	1990	2000
Demand	48	58	60
Production*	34	44	41
Import Demand	14	14	19
Contracted Supplies	13	--	--
Norway	13	12	--
Shortfalls (surplus)	--	2	19

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[a]Numbers may not add to totals shown due to rounding.
[b]Actual trade.
*Low end of UK future production estimate.

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Table 7

Norway: Natural Gas Supply and Demand[a]

(billion cubic meters)

	1983[b]	1990	2000
Demand	--	--	--
Production*	22	28	16
Import demand	(25)	(28)	(16)
Shortfall (surplus)	--	(28)	(16)

[a]Numbers may not add to totals shown due to rounding.
[b]Actual trade.
*No future production from Sleipner or Troll.

Table 8

Netherlands: Natural Gas Supply and Demand[a]

(billion cubic meters)

	1983[b]	1990	2000
Demand	36	32	32
Production*	68	67	54
Import demand	(35)	(35)	(22)
Shortfall (surplus)	--	(35)	(22)

[a]Numbers may not add to totals shown due to rounding.
[b]Actual trade.
*Continued high future production.

Table 9
Japan: Natural Gas Supply and Demand
(billion cubic meters)

	1983[a]	1990	2000
Demand	28.0	51.8	61.1
Indigenous Production	1.6	4.3	5.0
Import Demand	26.4	47.5	56.1
Contracted supplies	28.5	40.0	28.4
Abu Dhabi	2.9	2.9	--
Alaska	1.4	1.4	--
Brunei	7.3	7.3	--
Indonesia	15.2	19.9	19.9
Malaysia	1.7	8.5	8.5
Renewable or Planned Contracts	--	12.6	22.8
Abu Dhabi	--	--	2.9
Brunei	--	--	7.3
Canada	--	4.1	4.1
Australia	--	8.5	8.5
Potential contracts	--	--	up to 43.5
Alaska	--	--	22.1
Qatar	--	--	up to 8.5
Thailand	--	--	4.3
USSR-Sakhalin	--	--	4.3
Indonesia	--	--	4.3
Supply shorfall (surplus)	(2.1)	(5.1)	(up to 38.6)

[a]Actual trade.

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SOVIET STRATEGY REGARDING ENERGY EXPORTS

3 December 1984

Soviet Economy Division
Office of Soviet Analysis
Central Intelligence Agency

25X1

Soviet Strategy Regarding Energy Exports

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Soviet Strategy Regarding Energy Exports

Summary

The Soviet Union has the potential to double hard currency export earnings from oil and gas by the end of the century. The key determinant will be the level of domestic oil production and the ability to export additional gas to Western Europe in the 1990s. 25X1

If the Soviets can hold domestic oil production at about the current rate--12 million barrels per day (b/d)--through the year 2000 by a combination of new discoveries, increased purchases of Western oil equipment and technology, and improved oilfield operations, annual hard currency earnings from oil exports in nominal prices could be maintained at the 1983 level of nearly $16 billion in 2000. Again, under our price assumptions, even with no additional gas sales beyond those covered under existing contracts, hard currency gas earnings could rise to about $13 billion. Altogether, oil and gas earnings would amount to $29 billion in 2000. In real (1983 dollar) terms, however, Soviet hard currency receipts from oil and gas exports in 2000 would be only $13 billion under this scenario, 32 percent less than in 1983. 25X1

Should domestic oil output fall because of continued oilfield operating problems, denial of needed Western equipment, a more realistic view on the part of the leadership of the high burden on the economy of investment in the oil industry, and deteriorating reserve quality, the Soviets will have difficulty maintaining oil exports for hard currency. Even with deep cuts in deliveries to client states in Eastern Europe and elsewhere and a successful conservation and substitution program at home, a decline in annual oil production of some 2 million b/d by the end of the century could nearly wipe out oil exports for hard currency. In this scenario, natural gas exports would have to carry the load. If the Soviets managed to double gas exports in the 1990s, hard currency earnings in 2000 from energy exports (in nominal prices) would be nearly 50 percent greater than last year's level, but real earnings would fall by 35 percent. 25X1

The gloomy prospects we believe exist for Soviet oil production and export availability would spell trouble for the Soviet hard currency payments position. Constraints on exporting energy for hard currency could well force the USSR to reduce real hard currency imports at least through 1990. Hard currency imports represent a very small share of Soviet GNP but are important in meeting Soviet agricultural import needs. Moreover, imports of Western technology have helped Moscow deal with serious problems in the energy, chemical, and automotive sectors and would help the USSR carry out an urgently needed modernization program. In these circumstances, the USSR will have every incentive to offer large additional supplies of natural gas to Western Europe at prices below those available

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from prospective competing sources. It has, moreover, the gas reserves and technical capability to do so. 25X1

In setting priorities for its hard currency imports, Moscow probably will give preference first to agricultural commodities and second to needed industrial materials, especially for the energy sector. Soviet purchases of Western machinery and equipment probably will focus on agricultural and food processing equipment, machine tools, construction and transportation equipment, process control and other electronics, and chemical production technology. 25X1

We have used a balance-of-payments accounting model to project trends in the USSR's hard currency accounts through the year 2000 under two scenarios each for oil and gas exports. In one case, we have assumed that Moscow holds the ratio of debt at about the same low level that has occurred for the past decade. Even under the high oil-high gas export scenario, Soviet import capacity declines through 1990 before picking up in 1991-2000. 25X1

In our second case, we assume that the Soviets abandon their conservative borrowing policy. Even under the high oil-high gas export scenario, the Soviets could hold real import capacity at the 1983 level through 1990 only by allowing the debt-service ratio to rise to nearly 40 percent. The massive buildup of debt would push the rates even higher in the 1990s under a constant import case, to 50 percent or more. Because we believe it highly unlikely that Moscow will accept such high debt burdens--and assuming our export projections hold--the USSR might have to accept cuts in its real hard currency import capacity at least through 1990. 25X1

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Soviet Strategy Regarding Energy Exports

Introduction

This paper examines the role of oil and gas exports in total Soviet hard currency earnings, analyzes Moscow's apparent strategy in allocating available energy supplies, and looks at the import priorities of the Soviet economy in the 1985-2000 period. First, prospects for oil and gas production and Soviet tactics with respect to energy exports to the West are discussed. We then develop several oil and gas export scenarios and calculate future hard currency earnings. The paper concludes with a set of projections of total Soviet hard currency purchasing power and import capacity. 25X1

Background

Recent Trends in Energy Exports

Over the last two decades, the USSR has relied on rapidly rising production of oil and natural gas to stimulate the economy, to satisfy rising domestic energy demand, to achieve political objectives in Eastern Europe, and to acquire needed Western grain, technology, and equipment. Oil exports have long been a key source of revenue for the USSR, particularly hard currency earnings. After World War II, exports of crude oil and petroleum products increased apace with Soviet oil production. Exports now represent almost 30 percent of total Soviet oil supply (see table 1).[1] The USSR exported 3.6 million barrels per day (b/d) last year, with about one-half this amount going to non-Communist countries. 25X1

Soviet exports of natural gas are a more recent phenomenon as sales to the West began only in 1968. Although gas exports have risen sharply in recent years, they represent a decreasing share of total Soviet gas supply (see table 2). The USSR exported about 61 billion cubic meters of gas in 1983; about 42 percent of this amount was delivered to West European countries. 25X1

Hard Currency Earnings from Energy Exports

If it had not been able to export large amounts of oil and natural gas, the USSR could not have imported nearly as much as it has from the West in recent years unless it had been willing to abandon its conservative borrowing policy. Soaring prices for oil in the 1970s accounted for about 45 percent of the $25-

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Table 1

USSR: Recent Trends in Oil Production and Exports

	Million Barrels/Day		Exports as a Percent of Production
	Production[a]	Exports	
1970	7.1	1.9	27
1975	9.8	2.6	27
1980	12.0	3.3	28
1981	12.2	3.2	26
1982	12.3	3.4	28
1983	12.3	3.6	29

a Including gas condensate.

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Table 2

USSR: Recent Trends in Natural Gas Production and Exports

	Billion Cubic Meters		Exports as a Percent of Production
	Production	Exports	
1970	198	3	2
1975	289	19	7
1980	435	56	13
1981	465	62	13
1982	501	62	12
1983	536	61	11

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billion increase in total hard currency exports between 1970 and 1980 (see table 3). During this period, the volume of oil exports for hard currency rose 57 percent while the value increased 186 percent. Because oil prices increased much faster than prices for non-oil exports, the value of oil in total Soviet hard currency merchandise exports climbed from 15 percent in 1970 to 44 percent in 1980. The share of oil in total hard currency exports continued to increase to 48 percent in 1981-83 only because Moscow was able to boost the volume sufficiently to more than offset declining prices. Natural gas has become an important source of hard currency since the late 1970s when the Orenburg pipeline began operation. By 1983, combined exports of oil, gas, coal, and electricity accounted for nearly three-fifths of total Soviet hard currency merchandise exports.[2] 25X1

Apparent Soviet Strategy in Allocating Available Energy Supplies

One of the most difficult policy challenges facing the USSR is how to allocate its energy output. While the domestic economy will continue to require large and increasing amounts of energy to maintain positive growth rates, Moscow will also need to meet energy export commitments to its client states and export enough to the West to meet hard currency requirements. Oil production is stagnant and may begin to decline this year. If this decline continues, the USSR will have to cut back domestic supplies, exports to its CEMA clients and other soft currency customers, deliveries to hard currency countries, or some combination thereof. With its abundant natural gas resources, the USSR has been encouraging greater use of gas in its own economy and in the economies of Eastern Europe and has been increasingly aggressive in lining up Western buyers to raise hard currency. 25X1

Domestic Use. The Soviets have not given energy conservation the priority needed to hold down domestic demand for fuels. Nevertheless, the Soviets have achieved some success in limiting the growth in oil consumption, primarily through conversion from oil to natural gas in industry and some conservation. Progress in fuel conversion has been slow--far below plan--and prospects for substantial gains in the short run are limited. Agriculture and transport are not set up to use other fuels, and the investment required to convert other industries to alternative fuels will slow the rate of conversion. 25X1

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2 The Soviets export only small amounts of coal and electricity to the West for hard currency. Soviet earnings from coal exports totalled $215 million in 1983 and electricity exports were less than $1 million. We see little prospect for large-scale increases in sales of these energy sources to the West in the period under consideration and have not included them in our analysis. 25X1

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Table 3

USSR: Hard Currency Export Earnings, by Major Commodity[a]

(billion current US $)

	1970	1975	1980	1981	1982	1983
Total	2.8	9.8	27.8	28.0	32.0	32.4
Oil	0.4	3.4	12.3	12.2	14.8	15.6
Natural gas	NEGL	0.2	2.7	4.0	3.7	3.2
Machinery and equipment[b]	0.2	0.6	1.5	1.5	1.9	2.0
Wood	0.4	0.7	1.5	1.0	0.8	0.9
Chemicals	0.1	0.2	0.8	0.8	0.7	0.7
Agricultural products	0.2	0.5	0.5	0.6	0.6	0.4
Military goods[c]	0.4	1.5	4.2	4.2	5.9	6.0
Other	1.1	2.5	4.4	3.7	3.6	3.6

[a] Detail may not add to total because of rounding.

[b] These data probably include some military-related machinery and equipment such as helicopters and trucks.

[c] Estimated. Excluding the value of arms-related commercial exports to LDCs and the value of follow-on services.

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[redacted] 25X1

There is some evidence that the Soviets are forcing some conservation by not delivering planned allotments to domestic installations. In some cases, even factories are being sent less oil than originally planned. In other cases they are receiving whatever fuel is available, even if it is not compatible with operational requirements. So far, such cutbacks in domestic allocation probably have had little effect on economic growth because they have been relatively small. They indicate, however, that the place of domestic oil deliveries in the pecking order of Soviet fuel allocations is not cast in cement. Moscow evidently is willing at the margin to ration oil to its own economy to maintain exports--perhaps to meet hard currency earnings targets based, at least in part, on expected import requirements. [redacted] 25X1 25X1

Needs of Client States. The USSR exports about half of its oil to CEMA partners and other socialist client states, most of which are nearly totally dependent upon Soviet oil. In recent years the Soviets have been trying to reduce the burden to the USSR of fueling these economies in order to free up supplies for export for hard currency. When the USSR ran into hard currency difficulties in 1981-82, for example, it cut exports to most East European countries by about 10 percent in order to boost sales to the West. These reductions, which have been maintained in 1983-84, suggest that oil deliveries to Eastern Europe may be trimmed when the USSR needs cash. [redacted] 25X1

Exports to the West. Although oil exports to hard currency customers are still increasing, they are now rising at a slower rate, suggesting that the USSR is approaching its limit in boosting exports for hard currency with domestic-origin oil. Twice this year--during February-April and again in September-October--Western oil traders reported a scarcity of Soviet oil on the world market. The USSR claimed that the disruptions in the early part of the year were a result of bad weather that caused production and distribution problems. The Soviets did not comment on the disruptions this fall, perhaps because they were brief and not too noticeable. More recently, the Soviets declared force majeure on some oil liftings for December delivery from their Baltic and Black Sea terminals. Moscow asserts that increased domestic consumption and adverse consequences of bad weather on oil production are responsible. [redacted] 25X1 25X1 These events highlight how thinly the Soviets have spread their oil commitments and their increasing inability to meet export obligations when logistical problems arise. [redacted] 25X1

To help ease the pressure to export oil for hard currency, the Soviets have been aggressively pursuing natural gas sales to Western Europe. By 1990, Soviet gas deliveries will likely double last year's rate and will become an increasingly important source of hard currency. [redacted] 25X1

[redacted] 25X1

[redacted] 25X1

Import Priorities, 1985-2000

In large part because of the limitations the USSR faces in exporting energy for hard currency, we believe it unlikely that the Soviets will be in a position to sustain real growth in hard currency imports over the rest of the 1980s. In fact, they may have to accept a decline. The outlook for the 1990s is considerably better. In terms of the overall Soviet economy, these imports are relatively small, accounting for only 5 percent of gross national product. In real terms they have grown no faster on average than GNP since 1976. But hard currency imports have played a particularly important role in supplying Soviet agricultural needs. Imports of specialty steels and of large-diameter pipe for the gas pipeline system have also been critical. On the other hand, the share of machinery and equipment from hard currency countries in total Soviet machinery and equipment investment has been declining since 1976 and is now estimated at less than 10 percent. Nevertheless, imports of Western technology have undoubtedly helped Moscow deal with some serious problems, notably in the energy sector and in the chemical and automotive industries. The extent to which the Soviet Food Program succeeds in making the USSR more self-sufficient in agricultural production will largely determine how much non-agricultural equipment the Soviets can import within the conservative borrowing limits they seem to have established. [redacted] 25X1

[redacted] 25X1

Over the 1985-2000 period, we believe the USSR, at a minimum, will want to a) import sufficient quantities of farm products to keep per capita consumption of quality foods near present levels, b) purchase necessary industrial materials, and c) buy enough machinery and technology to meet priority investment goals. It is likely that if forced to choose among these needs because of hard currency constraints and continued unwillingness to increase dependence on Western credits, Moscow would try to ensure its imports of essential agricultural commodities at the expense of non-agricultural imports. Its second priority would be the industrial materials needed to prevent production bottlenecks and equipment and technology to help develop and exploit energy sources. If unable to acquire Western goods, the Soviets could go it alone, but only with substantial losses in quality, reliability, and productivity. If deprived of advanced Western technology, however, the USSR could not adjust quickly or completely; valuable time would be lost, adding significant strains to the economy. [redacted] 25X1

Agricultural products

The USSR has been a net importer of agricultural products for more than a decade. Agricultural imports have claimed about one-third of total hard currency purchases since 1980 (see table 4). Grain--the USSR's largest farm product import--is supplied mainly by the West and accounts for one-half of total hard currency agricultural imports. The need for grain derives from

[redacted] 25X1

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Table 4

USSR: Hard Currency Imports, by Major Commodity[a]

(billion current US $)

	1970	1975	1980	1981	1982	1983
Total	3.0	14.6	26.1	27.8	27.5	27.7
Grain[b]	0.1	2.3	4.5	6.4	5.5	4.9
Other agricultural products[b]	0.7	1.8	4.7	5.3	4.5	4.2
Machinery and equipment[c]	1.0	4.6	6.0	4.5	6.1	7.0
Ferrous metal products[c]	0.3	2.6	3.6	3.6	4.2	3.7
Chemicals	0.2	0.7	1.6	1.6	1.5	1.4
Other	0.7	2.6	5.5	6.4	5.8	6.5

[a] Detail may not add to total because of rounding.

[b] These data probably exclude some imports of agricultural products which cannot be identified in Soviet trade statistics. These imports are included in the "other" category.

[c] Excluding purchases for the Orenburg natural gas pipeline. These imports are included in the "other" category.

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the early years of the Brezhnev-Kosygin regime, when the leaders promised consumers larger supplies of meat and other livestock products. Meat availability has become a yardstick by which the Soviet consumer measures the change in his level of living and thus is important for worker morale and productivity. 25X1

Hard currency expenditures for non-grain agricultural products--largely meat, butter, vegetable oil, sugar, and soybeans and soybean meal--also have risen sharply over the past decade. Without these food imports, per capita availability would have declined substantially, and the average diet would have been even more monotonous. Imports of soybeans and soybean meal have been used to stretch livestock feed supplies and improve the protein content of feed rations. They have become more important as domestic output of oilseeds has declined.

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Although Moscow is placing great emphasis on agricultural self-sufficiency, we estimate that imports of about 30 million tons of grain and 2-3 million tons of oil seeds and oilseed meal will be needed annually to support livestock expansion plans through at least the mid-1990s, even with normal grain harvests.[3] Imports of other farm products will depend on domestic production and the extent to which the Soviet leadership is committed to maintaining per capita consumption levels. 25X1

Industrial Materials

The USSR relies to varying degrees on the West for imports of large-diameter pipe, specialty steels, molybdenum, raw and intermediate phosphate materials, plastics, dyes, pesticides, man-made fibers, and chemical catalysts. Total hard currency purchases of tubular steel products reached a high in 1982-83 with construction of the Siberia-to-Western Europe gas pipeline. Soviet imports of chemicals from hard currency countries have declined since 1980 to only $1.4 billion last year, but Moscow continues to import superphosphoric acid to produce high-quality fertilizers. 25X1

In the near future, purchases of large-diameter (1,020-1,420 mm) pipe will remain critical for the construction of oil and gas pipelines. But by the late 1980s, the Soviets should be able to scale back pipe purchases as domestic manufacturing capacity is put into operation. In addition to pipe, the Soviets will continue to buy large amounts of cold-rolled sheet steel for the machine-building, automobile, and consumer durables industries; tin plate for canning and packaging; and various types of high-quality metal products for use in transformers and electric motors. Purchases of these products may decline after

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3 The projection for grain imports assumes a continuation in 1985-95 of the 1950-83 trend in Soviet grain production. 25X1

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1986 or 1987, when the Novolipetsk metallurgical plant is expected to go into full operation. 25X1

Moscow is expected to continue to buy phosphate materials, plastics, dyes, pesticides, man-made fibers, and catalysts from the West. To this end, it has in place a number of long-term trade and technical cooperation agreements with Western firms calling for major exchanges of products and technologies. Among the most important is a $6.5-billion, 10-year reciprocal trade agreement with the French firm Rhone Poulenc to supply equipment and technology, pesticides, fertilizers, and animal feed in exchange for such energy-intensive chemicals as naphtha, ammonia, and methanol. Similar though smaller agreements have been signed with British and Italian companies. Other raw material needs will include metal ores and alloying materials of strategic importance to both Soviet civilian and military industries, especially tungsten, molybdenum, and manganese. 25X1

Machinery and Equipment

Moscow is likely to continue to import sizable quantities of machinery and equipment from hard currency countries--these purchases totaled $7 billion in 1983. 25X1

Real purchases of Western machinery and equipment declined substantially in 1977-81 as Moscow attempted to hold down total hard currency imports in order to limit dependence on Western credits. Although imports of machinery and equipment rose in 1982-83 with deliveries for the Siberia-to-Western Europe pipeline, they remained below the 1976 level in real terms. A factor in Moscow's approach to Western technology and equipment probably is the expressed disappointment over the contribution it has made to industrial output. Some sectors have experienced difficulties in absorbing the new technology. Even in those areas where Western technology clearly has helped (computers, the automotive and chemical industries, and oil and gas exploration and development), the diffusion to Soviet-designed and equipped plants has been minimal. 25X1

The leadership perceives that importing Western technology is not a panacea for the economy and that policy should concentrate on improving the performance of Soviet research and development and strengthening its ties with production sectors. Nevertheless, the Soviets will continue to look to the West for certain types of equipment and technology either not available at all or in the degree of sophistication desired from domestic production or Eastern Europe. 25X1

We believe Soviet needs for Western machinery and equipment in the 1985-2000 time frame will focus on items for the energy industries, agricultural and food processing equipment, machine tools, construction and transportation equipment, process control and other electronics, and chemical production technology. 25X1
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Prospects for Soviet Energy Production and Consumption

Moscow's recently announced long-term energy program for the period 1981-2000 highlights the need to substitute gas for oil wherever possible throughout the economy up to the early 1990s. Thereafter, coal and nuclear energy would be increasingly used to supplement gas. The program implies that oil production is to be maintained at or near its current level of about 12 million b/d. Natural gas output will expand rapidly until the mid-1990s and then begin to level off. 25X1

Given the prospects for scarce oil and abundant natural gas, success in energy conservation and interfuel substitution could greatly ease the overall energy situation. But Soviet prospects for substantial energy conservation through the end of the century are limited by several factors: the orientation of the economic system, which emphasizes output far more than efficiency; the modernization needs in some sectors that will make them more, not less, energy-intensive; the extensive use of old, inefficient equipment--a situation perpetuated due to low retirement rates; and efficiency levels already attained in some sectors, such as electric power, that make further gains difficult. The historic rise in the energy-GNP ratio, a measure of energy efficiency, has been halted since 1980, due in part to the increased use of more efficient natural gas relative to other fuels. Also, the expansion of groups set up to monitor energy use more closely are presumably having some effect. Soviet economists have stated that a stable energy-GNP ratio is perhaps the best they can expect in the near future. We basically agree with this conclusion. Investment in more energy-efficient industrial processes--continuous steel casting, dry processing of cement, and so forth--will be costly. If built, the impact of these new processes will be muted by the preponderance of older, less-efficient equipment remaining in operation. 25X1

Thus far, substitution away from oil in the electric power sector has been far less than planned. For example, oil use in power plants was scheduled to decline by about 1 million b/d in 1981-85. Oil consumption has declined little, however, due to unexpected shortfalls in coal supplies and above-plan generation of electricity. Some gas substitution plans, particularly the recently announced goal to save as much as 235,000 b/d of gasoline (nearly 15 percent of Soviet gasoline output) in 1985 by using compressed natural gas in motor vehicles border on the absurd. Although Soviet performance in terms of conservation and substitution will probably improve in the future, the real possibility of declining oil production--perhaps to as little as 10 million b/d by the year 2000--does not augur well for the maintenance of oil exports. 25X1

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Soviet Tactics to Increase Energy Exports to the West

Soviet Oil Pricing Policy

Moscow's oil trade with hard currency customers is conducted on a commercial basis and reflects supply and demand in international markets. Soviet oil sales to the West have been attuned to Western market conditions and the general acceptance of competitive contract and spot market prices. Because the USSR is a relatively small oil supplier to Western countries, it must match world prices to remain competitive.[4] Soviet behavior in the last few years of a weak oil market has been characterized by frequent adjustments to its oil prices, both up and down. 25X1

Soviet Gas Pricing Policy

Recent soft market conditions for the sale of natural gas in Western Europe--resulting from depressed economic activity, unseasonably warm winters in 1982-83 and 1983-84, and increased energy conservation--have been a useful laboratory in which to observe Soviet gas-pricing behavior. Throughout this period, the Soviets were forced to price gas exports 15 percent below the price of the principal competing energy source--fuel oil--on an energy equivalent basis. 25X1

Last summer's Soviet offer of gas at a 15-percent discount to Belgium (reported by press and industry sources) demonstrates Moscow's ability to affect pricing decisions in the West European gas market. In June the Belgian gas utility was unsuccessfully seeking a discount on gas purchased from its Dutch gas supplier to permit cheaper supply to Belgian ammonia producers, who were suffering from French and Dutch competition. The Soviets offered cheap gas for the Belgian fertilizer producers on a spot market basis. Once Belgium had developed a credible alternative by means of the Soviet offer, the Dutch gas utility provided the Belgians with lower-priced gas. The Soviet option will reportedly remain in force through 1985, which will permit Belgium to brandish it again when the terms of its LNG contract with Algeria are renegotiated next year. 25X1

Media reports have observed that Soviet gas prices to Italy were more than competitive when the long-pending contract for the sale of Urengoy gas was signed last May. Italy used the Soviet price to force the Netherlands to absorb transit costs on Dutch gas. Disclosure in the press of the low Italian price, added to other reports of Soviet discounts, prompted France to seek a 10-percent reduction in price on its contract for Urengoy gas. In addition, West Germany, in its discussions with the Soviets,

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4 Soviet oil accounted for only 7 percent of non-Communist oil trade in 1983. 25X1

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apparently received a verbal agreement for a 10-percent discount. 25X1

The events described above underscore Moscow's ability to expand gas exports to Western Europe at prices calculated to increase the Soviet market share. In the present buyers' market, however, Soviet restraint is to be expected, because reductions in official gas prices can also influence the long-term contract price for Soviet oil. Although hard currency earnings from gas exports will likely double by 1990 and oil exports may be in decline, Moscow's interest in sustaining the contract price for oil will persist. 25X1

The USSR has the resources, technical capability, and economic motivation to offer large additional supplies of natural gas to Western Europe at prices below those available from any prospective competing source. Soviet incentives to do so will increase sharply if oil production and exports to the West decline in the years ahead. Soviet ability to undersell all other suppliers could convince Western producers and governments that proceeding with more costly development of new Norwegian offshore gas fields would be uneconomic. The USSR would then be able to obtain a much larger share of the West European energy market and potentially have the power not only to affect the final demand and price for other fuels but also the ability to exercise political leverage. 25X1

OPEC Barter Arrangements and Reexports

For the past several years the USSR has increasingly relied on oil obtained from OPEC to help ease the pinch in oil supplies. The OPEC shipments are made in lieu of currency payments for earlier deliveries of Soviet arms and equipment that some of the oil-producing countries would otherwise have found difficult or not been able to make. The Soviets were able to boost their hard currency oil exports last year in part by reexporting an estimated 255,000 b/d, 30 percent more than during 1982. Nearly one-half this amount came from Libya. So far in 1984, reexports are continuing at about last year's level. 25X1 25X1

Much of the reexported oil is sent to soft currency countries--primarily Finland and India--and the rest is sent to hard currency markets--mostly in Western Europe. Oil sent to soft currency countries frees up an equivalent amount of Soviet oil for export to hard currency countries. Last year, liftings of reexported oil constituted about one-sixth of total Soviet oil exports to hard currency markets. 25X1

As long as the oil market remains soft, these deals will almost certainly continue, and could proliferate if goods other than arms are exchanged for the oil. If the demand for OPEC oil strengthens, however, hard-pressed cartel members should be able to increase oil exports. These members would then be in a better

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position to pay their debts in cash and may be less inclined to engage in barter deals with the USSR. 25X1

CEMA Claimants and Bilateral Commitments

The USSR has not made firm energy commitments to its CEMA trading partners beyond the 1986-90 period. Moscow has said that the USSR will continue to supply the East European countries with oil and increase future shipments of gas and electricity through 1990. At the June CEMA summit meeting, however, it warned that delivery of energy and other raw materials would be contingent on economic conditions in the USSR. This may mean that the Soviets will cut their exports of oil and other raw materials to CEMA if faced with too severe a drop in hard currency receipts from the West. Moscow continues to emphasize that the East Europeans must pay for their energy imports with better quality goods and a greater quantity of exports as well as investing in Soviet resource development. 25X1

The East European nations have been signing up for more Soviet gas but probably will not take as much as Moscow would like. Conversion from oil to gas in the largely coal-based economies of Eastern Europe is difficult. Progress in this direction has been slow so far and will continue to be slow because of the time and investment required. We do not believe increased availability of Soviet gas will substantially ease the demand for oil in client states at least through the remainder of the 1980s. 25X1

Energy Export Scenarios and Hard Currency Earnings

To project future hard currency earnings from energy exports, we have developed two scenarios for oil and gas exports to the West. The variation between the two scenarios for oil exports is based on the uncertain outlook for domestic Soviet oil production and a series of assumptions about the minimum oil needs of Soviet client states in Eastern Europe and elsewhere and other soft currency trading partners, notably Finland. The two gas export scenarios are based on our estimate of the current capacity of existing pipelines to Western Europe (for the low case) and the probable maximum amount of Soviet gas that could be absorbed under conditions of rising demand and low indigenous production (for the high case). This latter scenario would require the constructon of the equivalent of two additional "export pipelines" as well as relaxation of Western concerns about relatively high percentages of dependency on Soviet gas and the absence of economically viable Western gas supply alternatives. 25X1

Oil

In the high oil export case, we have assumed that the Soviets, through a combination of new discoveries, increased purchases of Western oil equipment and technology, improved

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oilfield operations, and the production of a small amount of synthetic liquid fuels manage to hold oil output at about the current level through the end of the century, that is, 12 million b/d. For the low export scenario, we have assumed that domestic oil production begins to decline gradually--as it probably will do this year--to about 10 million b/d in 2000. Continued oilfield operating problems, a more realistic view on the part of the leadership of the high burden on the economy of investment in the oil industry, and rapidly deteriorating reserve quality would be consistent with this scenario. 25X1

On the consumption side, we believe the Soviets can continue to reduce oil use through conservation and substitution, holding domestic oil demand in 2000 to perhaps about the same level as it was last year, 9 million b/d. The increasing demands for quality light petroleum products in the transportation and agricultural sectors can be offset by large-scale substitution of natural gas in electric power plants and industrial boilers and "deeper" oil refining. Some Western assistance may be required if the Soviets are to be successful in reducing the amount of heavy oil products refined from a barrel of crude oil. We assume the Soviets will continue to reexport OPEC oil as a way to settle trade accounts for arms and other deliveries, but we see little opportunity for sizable increases in reexports as a way to maintain oil exports. 25X1

As discussed above, the oil needs of Soviet client states will continue to have a high priority, although probably not as high as the requirements of the domestic economy or hard currency exports, at least at the margin. The USSR will continue to encourage its CEMA trading partners to accept more Soviet gas and to conserve energy, but we believe there is a limit to which oil deliveries could be cut back in the future. The Soviets have managed to increase hard currency exports in each of the last two years through a combination of some belt tightening at home, boosting reexports from OPEC countries, and reducing deliveries to client states. But there are both economic and political limits to continued cutbacks at home and for export to other Communist countries. Even in the high export scenario, we estimate additional cutbacks in deliveries to client states will be necessary, although the reductions could probably be held to 10 percent or so by 1990. In the low export scenario, however, deeper cuts will be necessary, perhaps as much as one-third by 1990. We believe the Soviets would be unwilling to risk further cutbacks which could threaten the economic or political collapse of client states, particularly in Eastern Europe, even if it meant a severe reduction in hard currency oil exports. 25X1

The needs of non-Communist soft currency countries will also play a role in determining the amount of oil available for export for hard currency. The bulk of oil exported to these countries--nearly 70 percent in 1983--goes to Finland, an important and special Soviet trading partner. The Soviets rely on Finland for

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a variety of goods, notably ships and other transport equipment. In turn, Helsinki receives nearly 90 percent of its oil needs from the USSR. Such a mutually beneficial trading relationship is unlikely to be radically upset. 25X1

If we accept the assumptions set out above about the availability and allocation of oil, Soviet hard currency oil exports can be calculated as a residual. Coupled with assumptions about the likely movement of oil prices throughout the period, we can project hard currency earnings under the two scenarios.[5] In the high export scenario, with constant domestic oil output, slightly increasing domestic consumption, and only marginal cuts in deliveries to soft currency customers, the volume of hard currency exports falls from 1.4 million b/d in 1983 to roughly 900,000 b/d in 1990 with about a one-third loss in earnings (see table 5). Some success in reducing the rate of growth of oil use at home through conservation and substitution, together with rising prices in the 1990s, should enable Moscow to maintain hard currency earnings from oil in 2000 at about $16 billion. In 1983 prices, however, earnings would be only about $7 billion. 25X1

The driving force in the low export scenario is falling domestic oil output. Even with deep cuts in shipments to client states and declining oil consumption at home, the Soviets would be able to export only about 200,000 b/d for hard currency by the end of the century. Under this scenario, hard currency earnings would fall to only one-third their present level in 1990, and to only $4 billion in 2000. 25X1

Natural Gas

The outlook for Soviet hard currency gas exports is much better than that for oil sales. With 40 percent of the world's proved gas reserves and practically no constraint on domestic output except demand, the USSR will be able to increase gas exports, limited only by what customers are willing to buy. We have assumed that production will be determined by the combination of domestic and export demand. We have again chosen two scenarios. The low export scenario is based on the projected level of deliveries under existing contracts with some modest expansion in the 1990s up to the capacity of existing or soon-to-be-completed domestic and transit pipelines. The high scenario assumes not only a larger increase in West European gas demand in the 1990s, but the willingness of West Germany, France, Italy and possibly some other countries to become dependent on the Soviet

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5 Prices are assumed to remain constant in nominal terms through 1990, rise at the postulated rate of general inflation (5 percent) in 1991-95, and rise at 2 percentage points above the 5-percent inflation rate in 1996-2000. 25X1

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Table 5

USSR: Oil Export Scenarios

	1983	1985	1990	1995	2000
					(million b/d)
Production[a]	12.3	12.1	11.0-12.0	10.5-12.0	10.0-12.0
Consumption	9.0	9.2	9.3	8.9-9.4	8.6-9.4
Net exports	3.3	2.9	1.7-2.7	1.6-2.6	1.4-2.6
Imports	0.3	0.2	0.2	0.2	0.2
Gross exports:	3.6	3.1	1.9-2.9	1.8-2.8	1.6-2.8
to Communist countries	1.8	1.7	1.2-1.6	1.2-1.6	1.2-1.6
to other soft currency countries	0.4	0.3	0.2-0.4	0.2-0.4	0.2-0.4
to hard currency countries	1.4	1.1	0.5-0.9	0.4-0.8	0.2-0.8
					(US $ per barrel)
Assumed oil price[b]	30.50	30.50	30.50	38.93	54.60
					(billion current US $)
Hard currency earnings	15.6	12.2	5.6-10.0	5.7-11.4	4.0-16.0
					(billion 1983 US $)
Hard currency earnings	15.6	11.1	3.9-7.0	3.2-6.3	1.7-6.9

a Including gas condensate and synthetic liquid fuels.

b Prices are assumed to remain constant in nominal terms through 1990, rise at the rate of inflation (5 percent) in 1991-95 (constant real prices), and rise at 2 percentage points above the inflation rate in 1996-2000.

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Union for as much as one-half their gas supplies and the absence of large-scale Western alternative sources of gas. [redacted] 25X1

Under the low export scenario, Soviet gas exports to hard currency customers would gradually rise from about 26 billion cubic meters (m^3) in 1983 to 60 billion m^3 in the mid-1990s and remain at that level through the end of the century (see table 6). No new export pipelines would be required, and such a level of exports would be consistent with either slowly increasing demand or a decision on the part of the major West European customers to limit imports of Soviet gas. This, of course, would require development of new sources of gas to cover an expected demand gap of some 50 to 60 billion m^3 by the year 2000. Development of major Norwegian fields, particularly Troll, could cover most additional West European gas needs in the 1990s, but only if exploration and technical analysis is not long delayed and if buyers are willing to pay some sort of "security premium" for Western gas. In this scenario, Soviet hard currency gas earnings would rise from \$3.2 billion in 1983 to almost \$6 billion in 1990 and \$13 billion in 2000.[6] [redacted] 25X1

The high export scenario basically has the Soviets filling the entire West European supply-demand gap in the 1990s, that is, an additional 60 billion m^3 by 2000. Such an increase would require the construction of the equivalent of two new "export" pipelines. West European and Japanese steel producers would almost certainly be involved in what the Soviets would undoubtedly refer to as another "gas-for-pipe" deal. Hard currency export earnings from gas exports under this scenario would rise to \$24 billion in the year 2000 in nominal terms, 25X1
although in 1983 prices earnings would be only \$11 billion. [redacted] 25X1

We have not included earnings from potential gas exports of the joint Soviet-Japanese Sakhalin oil and gas development project in the hard currency calculations. [redacted] 25X1
If the project does get on track, only about an additional 4.5 billion m^3 of gas would be exported annually, worth about \$1 billion under our price assumptions, beginning probably in the mid-1990s. [redacted] 25X1

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[6] Our assumptions about gas prices are identical to those for oil with the exception that under the high export scenario we assume that the Soviets may be required to offer some sort of price concession to move large new quantities of gas into Western Europe. We have assumed that real gas prices will remain constant in 1991-2000 in this scenario rather than increasing slightly as in the low export scenario. [redacted] 25X1

[redacted] 25X1

Table 6

USSR: Gas Export Scenarios

	1983	1985	1990	1995	2000
					(billion cubic meters)
Production	536	620	778-786	928-952	950-1,000
Consumption	478	548	683	811	815-826
Net exports	58	72	95-103	117-141	124-184
Imports	3	3	3	3	3
Gross exports:	61	75	98-106	120-144	127-187
to Eastern Europe	34	37	50	58	65
to Finland	1	1	2	2	2
to Western Europe	26	37	46-54	60-84	60-120
to Japan	0	0	0	0	0
					(US $ per 1,000 cubic meters)
Assumed gas price[a]	123	123	123	157	200-220
					(billion current US $)
Hard currency earnings	3.2	4.6	5.7-6.6	9.4-13.2	13.2-24.0
					(billion 1983 US $)
Hard currency earnings	3.2	4.1	4.0-4.7	5.2-7.3	5.8-10.5

a Prices are assumed to remain constant in nominal terms through 1990 and rise at the rate of inflation (5 percent) in 1991-95. Two price assumptions are used for 2000: constant real prices for 1996-2000 in the high export scenario and increasing real prices (2 percentage points above the rate of inflation) in the low export scenario.

According to our calculations, with a combination of low oil exports and low gas exports, total Soviet hard currency earnings from oil and gas could fall from about $19 billion in 1983 to $11 billion in 1990 and then recover slightly to $17 billion in 2000 as prices rise. A high oil-high gas scenario would increase earnings to $40 billion by the end of the century. Other combinations yield earnings between these extremes (see table 7). 25X1

Prospects for Non-Energy Exports[7]

The USSR's hard currency earnings from exports of commodities other than energy amounted to about $13.4 billion in 1983, only two-fifths of its total hard currency receipts. We believe that earnings from exports other than energy, gold, and arms could be increased by as much as 3-4 percent a year. To achieve that increase, however, the Soviets would have to allocate more investment and manpower to a variety of industries at a time when they are short of both resources. In addition, Western demand would have to be robust enough to accommodate a large volume of Soviet sales. Because of these factors, we believe a more realistic real growth rate for these exports may be 0-2 percent per year. In the scenarios discussed below, we projected nonenergy export growth at 1.5 percent annually, an annual rate only slightly below the roughly 2.4 percent yearly average recorded during 1976-83. 25X1

The Soviets stand a fairly good chance of increasing hard currency earnings from sales of precious metals, nickel, chromium, and certain chemicals. The USSR's exportable surplus of platinum-group metals could well double by the end of the decade as a result of sharply increased production. Moreover, the Soviets are guaranteed sizable earnings from chemical exports as a result of long-term compensation and buyback deals with Western firms. 25X1

Moscow could also step up gold sales, which last year amounted to an estimated $800 million; these sales have fluctuated widely depending on Moscow's needs for hard currency funding. The Soviets could sell about 300 tons a year without dipping into reserves, but they would have to be careful not to push too hard because of potential price effects. 25X1

Chances are only fair, meanwhile, that the Soviets will be able to boost their hard currency earnings from sales of machinery exports or to increase earnings transshipping cargoes by rail between Europe and the Far East. Western demand for

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Table 7

USSR: Hard Currency Earnings from
Oil and Natural Gas Exports Under Various Scenarios

(billion current US $)

	1983	1985	1990	1995	2000
Low oil-low gas	18.8	16.8	11.3	15.1	17.2
Low oil-high gas	18.8	16.8	12.2	18.9	28.0
High oil-low gas	18.8	16.8	15.7	20.8	29.2
High oil-high gas	18.8	16.8	16.6	24.6	40.0

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Soviet machinery and rail services will probably remain weak. Nor do we foresee any dramatic increase in Soviet hard currency sales of arms to the LDCs, at least over the next few years. Major hard currency purchasers of military equipment--such as Libya, Iraq, and Syria--are facing financial difficulties which could well prevent them from increasing these imports. We do, however, foresee a continuation of military sales and assistance programs. Indeed, military assistance will remain a principal means of Soviet entree in many countries, and we anticipate more aggressive sales campaigns in the future. 25X1

In addition, chances are poor that the Soviets will be able to increase sales of timber and agricultural products. Real exports of these goods have declined over the past eight years and there are no indications that they will pick up soon. In the case of the timber industry, output has been declining and it 25X1 does not appear that Moscow is prepared to devote enough investment to this sector to enhance its export capability.

Hard Currency Import Scenarios

We lack the information needed to project actual import levels with any degree of accuracy, but the earlier discussion of Soviet import priorities suggests that the USSR will continue to need to import a substantial volume of goods from the West in the coming years. At the same time, the generally poor outlook we foresee for Soviet energy exports--particularly oil--suggests that Moscow may not have the wherewithal to sustain a continued real growth of hard currency imports even at the 2-percent average annual rate realized in 1977-83. Indeed, it appears likely that unless the Soviets are willing to increase substantially their debt service burden they will suffer a sizable decline in these imports. In addition to hard currency purchasing power, the volume of Soviet imports in 1985-2000 will depend on other factors, among them a) Soviet attitudes toward borrowing in the West and Western attitudes toward lending to the USSR, b) Soviet attitude toward dependence on Western goods, and c) Western willingness to export to the Soviet Union. 25X1

To suggest the magnitude of the USSR's hard currency needs and constraints, we have used a balance-of-payments accounting model to project trends in the USSR's hard currency accounts through the year 2000. The model, which consists of a series of standard accounting identities, projects overall payments trends with assumed values for key earnings items such as the volume and price of oil and gas, gold and arms sales, and level of Soviet borrowing (see insert). From these assumptions, the model generates Soviet import capacity through 2000. 25X1

In one set of scenarios (Financing Scenario A in Table 8), we assume that Moscow continues to maintain its past conservative policies and holds the ratio of debt service to total hard currency receipts at 20 percent or less, that is, about the same as the 17-percent level incurred since the mid-1970s. Even under

Assumptions Underlying Hard Currency Balance-of-Payments

Oil exports fall from 1.4 million b/d in 1983 to (a) 900,000 b/d by 1990 and 800,000 b/d by 2000 in the high oil export scenario, (b) 500,000 b/d by 1990 and 200,000 b/d by 2000, in the low oil export scenario, and (c) to 700,000 b/d by 1990 and 500,000 b/d by 2000 in the mid-point case. 25X1

Gas exports rise from 26 billion m^3 in 1983 to (a) 54 billion m^3 in 1990 and 120 billion m^3 in 2000, (b) 46 billion m^3 in 1990 and 60 billion m^3 in 2000, (c) 50 billion m^3 in 1990 and 90 billion m^3 in 2000. 25X1

Real nonoil, nongas exports grow by 1.5 percent a year in 1985-2000 after falling 7 percent in 1984. 25X1

Real arms sales show no growth in 1985-2000. 25X1

Real net earnings from invisibles (excluding interest) grow by 2 percent a year during 1984-2000. 25X1

Gold sales rise from 60 tons in 1983 to 300 tons by 1989 and then level off. 25X1

Real unrecorded expenditures or net lending (errors and omissions) are held at 15 percent--the average in 1980-83--of earnings from merchandise exports (including arms). 25X1

The overall annual inflation rate applicable to nonenergy exports and imports is 5 percent in 1984-2000. 25X1

Nominal oil prices remain at the 1983 level of $30.50 per barrel for the mix of crude oil and petroleum products exported to hard currency countries in 1983 through 1990 before rising at the rate of inflation (5 percent per year) in 1991-95 and then at 7 percent a year through 2000. 25X1

Nominal gas prices remain at the 1983 level of $123 per thousand m^3 through 1990 and then (a) rise with the rate of inflation through 2000 in the high gas and mid-point gas scenarios or (b) rise with the rate of inflation through 1995 and then at 7 percent a year in 1996-2000 in the low gas case. 25X1

The nominal gold price rises with the rate of inflation from $340 per troy ounce in 1984 to $750 per troy ounce in 2000. 25X1

Interest rates average about 11 percent. 25X1

The average maturity structure is 8 years on Western government-backed credits and 5 years on medium- and long-term commercial bank credits. 25X1

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Table 8

USSR: Hard Currency Projections

(billion 1983 US$)

	1983	1985	High Oil High Gas 1990	High Oil High Gas 2000	Low Oil Low Gas 1990	Low Oil Low Gas 2000	Mid Oil Mid Gas 1990	Mid Oil Mid Gas 2000
Total purchasing power	35.2	31.9	32.1	41.3	27.6	28.6	29.5	33.3
Merchandise exports	32.4	28.6	26.3	35.2	21.8	22.5	23.7	27.2
Oil	15.6	11.1	7.0	6.9	3.9	1.7	5.4	4.3
Natural gas	3.2	4.1	4.7	10.5	4.0	5.8	4.4	7.9
Other	13.6	13.4	13.9	15.0	13.9	15.0	13.9	15.0
Gold sales	0.8	1.1	3.3	3.3	3.3	3.3	3.3	3.3
Invisibles receipts[a]	2.0	2.2	2.5	2.8	2.5	2.8	2.5	2.8
Financing Scenario A								
Debt-service ratio (percent)	17	18	20	19	20	17	20	17
Import capacity	27.7	25.6	25.2	31.6	21.5	23.5	23.5	27.0
Financing Scenario B								
Debt-service ratio (percent)	17	20	39	50	56	180	48	108
Import capacity	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7

[a] Including interest receipts.

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the high oil-high gas scenario, Soviet import capacity would decline through 1990, before picking up in 1991-2000. Under the low oil-low gas scenario, real import capacity would decline considerably more before leveling off throughout the 1990s. By the year 2000, it would still be about 15 percent less than in 1983. 25X1

Western credits are a potential source of sizable additional hard currency imports, but only if Soviet debt policy becomes substantially less conservative. We have adjusted our model so that it will generate drawings on commercial credits--and debt service ratios--at a constant level of real imports (Financing Scenario B). Under the most optimistic energy export scenario, the USSR would have to let its debt service ratio rise to nearly 40 percent by 1990 to hold real import capacity constant in 1984-90. Because of the massive buildup of debt through 1990, the ratio would still be high--perhaps 50 percent by the year 2000. To maintain constant real imports under the low oil-low gas case, the USSR would have to permit its debt-service ratio to climb to 56 percent in 1990, and to 180 percent in 2000. Because we believe it highly unlikely that Moscow will accept such high debt burdens--and assuming our export projections hold--the USSR might have to accept cuts in its real hard currency import capacity at least through 1990. 25X1

Our projections are of course highly sensitive to the volumes of oil, gas, and gold sold. Each additional 100,000 b/d of oil sold would increase annual purchasing power by an average of roughly \$800 million, using the real prices we have assumed. Each additional billion cubic meters of natural gas sold would yield about \$100 million in real terms. And for each additional 50 tons of gold sold, real hard currency receipts would rise by more than \$500 million. 25X1

Finally, the results are also highly sensitive to world market prices for oil, gas, and gold. Every \$1 per barrel reduction in the real price per barrel of oil reduces Soviet hard currency purchasing power in 1990 by about \$330 million under the high oil export scenario, and a reduction of \$5 per 1,000 m^3 in the real price of gas per thousand m^3 would result in a loss of \$270 million in earnings. Another \$250 million in earnings would be forfeited if the price of gold were \$25 lower per troy ounce than we have assumed. Conversely, the Soviets would benefit if the real prices of their major export commodities were higher than we have assumed. If, say, the real prices of oil and gas remained level through 1990 instead of declining 5 percent a year as we have projected, the USSR would realize a gain of \$3.3 billion in its 1990 hard currency purchasing power under the high-oil high-gas scenario. This would allow Moscow to maintain imports at the 1983 level through 1990 with a debt-service ratio of roughly 33 percent instead of the 39 percent we have projected. 25X1

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Western Energy Technology and Equipment As a Factor In Soviet Energy Prospects

6 December 1984

Soviet Economy Division
Office of Soviet Analysis
Central Intelligence Agency

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Western Energy Technology and Equipment As a Factor In Soviet Energy Prospects

Summary

The role of Western technology and equipment in Soviet energy extraction will shift considerably between 1985 and 2000. The extent of the shift will depend partly on the increasingly complex technical challenges facing the Soviet energy industries and partly on the ability of Soviet research and manufacturing to provide needed technology and equipment. The greatest challenges will involve the oil and natural gas industries. The necessity for deeper drilling, offshore exploration and development, and exploitation of the sour oil and gas from high-temperature-and-pressure deposits in the Pre-Caspian Depression will call for a high order of technology and high-quality equipment--presently available only in the West. Although the Soviets are beginning to manufacture large-diameter high-pressure pipe suitable for gasline service, there will be continued need for at least some Western pipe, probably well into the 1990s.

Technology and equipment sought by the USSR for oil and gas exploitation involves computer hardware and software, metallurgy, sensors, and process technology that could advance Soviet military applications. The potential effectiveness of denial of these items to the USSR is affected by a number of considerations. In some cases, the Soviets can, at greater resource cost, produce the oil or gas using their own less efficient equipment. Where Western equipment is essential, as in sour gas production, denial would halt that production but additional gas could be readily obtained from the Tyumen' deposits. In nearly all cases, US technology and equipment are state-of-the-art, but more than adequate alternatives are available from Western Europe and Japan--and, for some items, from other countries in Asia and Latin America. Effective denial thus would require at a minimum the full and broad cooperation of the COCOM countries.

Energy Demand

The USSR is the world's leading producer of oil and natural gas; overall, the level of Soviet energy production is approaching that of the United States. By 1970, oil had displaced coal as the dominant fuel in the Soviet energy balance; we anticipate that by 1990 natural gas will account for the largest share of USSR's primary energy production. Sometime after 2000, according to the Soviet long-term energy plan, coal will reassert its dominance following an intensive development effort in the 1990s. 25X1

The pace of energy exploitation is governed not only by technical considerations affecting production and demand but also by bureaucratic considerations. The oil ministry, for example, has won what may be pyrrhic victories in its resource-allocation battles against the geology and coal ministries, with the result that oil production efforts have been pushed in the near term to the detriment of needed oil exploration and coal development. The quality of reserves is also an important consideration in the outlook for energy production. In the case of gas, a high quality reserve base offsets much of the negative influence on production activity of arctic

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climate, terrain, remoteness, and limited infrastructure. For both oil and coal, however, the declining quality of the remaining base of proved reserves compounds these negative influences. 25X1

Since 1980 Soviet oil production (including gas condensate) has flattened out, and crude oil production appears to be declining; later in the decade, slippage of total oil production is likely. Natural gas production has been growing at about 7 percent annually, and the outlook for continued growth is excellent. Coal production continues to stagnate. In terms of the relationship between changes in investment and output between 1975 and 1983, gas production (excluding pipeline costs) reflects a remarkable success story in contrast to the burdensome oil and coal production efforts. Gas output increased 85 percent while investment in gas production rose 50 percent; oil output was up by 26 percent, investment up 140 percent; and coal output was up 2 percent, investment up 35 percent. 25X1

Dependence on West

The USSR has achieved its present status as the world's leading producer of oil and natural gas largely through the use of indigenous equipment. The technology and equipment needed for most of its major development projects are currently available in the USSR and East European (Warsaw Pact) countries. We rate the quality and technical characteristics of Warsaw Pact equipment only low to adequate by Western standards, however, meaning that they are suitable for most current needs but will be increasingly inadequate for future requirements. 25X1

Moscow has turned to the West for selected high-quality and advanced state-of-the-art equipment and technology to obtain higher operating performance and reliable service, as well as to overcome shortages of key items. In recent years, pipe has accounted for the lion's share of Soviet imports for oil and gas exploitation and exploration and development equipment comprised most of the remainder. 25X1

Looking ahead to the 1985-2000 period, we expect Moscow to attempt to stabilize oil production, continue to expand natural gas production at least until the mid-1990s, and subsequently look to coal as the mainstay of the USSR's energy supply. Although Soviet and East European technology and equipment will suffice for much of this effort, special requirements for Western technology and equipment will exist if development of each of the major fuels is to proceed on schedule. But these requirements, often associated with specific projects, do not impose absolute constraints on all aspects of the Soviet energy effort. For example, more rapid development of northern Tyumen' gas deposits using indigenous technology and equipment could offset a lack of Western equipment needed for sour gas development in the Pre-Caspian Depression or Central Asia. 25X1

The continuing interest in Western technology and equipment in the oil and gas industries will center on advanced techniques of oil and gas exploration; corrosion-resistant equipment; equipment for high-pressure, high-temperature applications; systems for offshore exploitation; systems for drilling and producing deep wells; and possibly hydrocracking facilities for oil refineries. We judge that access to Western state-of-the-art technology and equipment would probably cut project development times in half.

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Nevertheless, even the immediate acquisition of such technology and equipment would not lead to new production until the mid-to-late-1990s because of the lead times involved in petroleum exploration and development--especially in northern Tyumen' and offshore. 25X1

Most critical to the Soviet effort are items of Western petroleum technology and equipment being sought for development projects in the major oil and gas zones of West Siberia; the Caspian, Barents, and Kara Seas; offshore from Sakhalin; and in the Pre-Caspian Depression. These items include state-of-the-art (computer-assisted in most cases) seismic and drilling equipment for oil exploration and specially designed production equipment packages for deep, high-pressure-and-temperature, corrosion-resistant service. The acquisition of Western technology for integrating, designing, and producing this equipment will probably receive equal priority. 25X1

More rapid and more efficient energy production from Soviet coal deposits also offers broad scope for application of Western technology and equipment. For mining the coal, indigenous capabilities are on the whole adequate. Because of the low coal quality and remoteness of deposits from consuming centers, however, more efficient means of energy transport are increasingly needed. The Soviets are examining several options, including coal slurry pipelines, conversion of coal into synthetic fuel, and ultra-high voltage transmission of electricity from mine-mouth power plants. For such processes, technology and equipment imported from the West could play an important role. 25X1

Military Implications

Substantial potential for diversion of Western petroleum technology and equipment to military-related use is believed to exist in the sale of "high-level" offshore hardware and software. Recent breakthroughs in offshore computer-assisted geophysical exploration and the integration of related hardware and software offer perhaps the greatest potential in this regard. Much of this technology has broad military-naval applications using image and signal data processing with realtime analysis for targeting, mapping, and locating. The technologies embodied in corrosion-resistant production equipment and in equipment for high-pressure-and-temperature operating conditions are applicable to conventional and nuclear weapons development, marine nuclear propulsion systems, military rocket and jet engines, and other applications in armaments. Moreover, the technology used in the matching of components and technological properties of hardware, as well as the metal-processing and shaping technology used to manufacture these items, has the potential to help Soviet military/defense research efforts. 25X1

During the past few years, the United States has developed a comprehensive policy aimed at stemming the flow of high-quality Western technology and equipment to the USSR and other Warsaw Pact countries by expanding and upgrading export controls. A formal US proposal addressing emerging technologies and 21 oil and gas technology and equipment items was tabled in COCOM, and several items were accepted for full COCOM control in January 1984. Partial control was obtained over several other items, and discussions on the remaining items were temporarily deferred or dropped, because unilateral US foreign policy controls covering the remaining exploration and production items were in place. 25X1

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Economic Impact

The potential economic impact of denial of Western oil and gas technology and equipment to the USSR during the 1985-2000 period cannot be stated in unequivocal terms. In some instances denial would force the use of second-best technology and equipment, causing delay and reduced efficiency but not stopping a project. In other cases a project might be stopped, but production of oil or gas from a different region might be stepped up to meet demand.

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The denial of state-of-the-art exploration equipment would almost certainly result in less efficient and less fruitful exploration efforts. Because of the lead times involved in oil and gas exploration and development, such denial would have little or no impact on production during most of the 1985-2000 period; but, in the late 1990s and beyond, oil production would decline faster than would the case if more efficient exploration had been possible. The negative impact would almost certainly affect offshore exploration more severely than onshore exploration. 25X1

Denial of production equipment for operation in corrosive and high-pressure, high-temperature environments would essentially halt progress in development of the petroleum resources in the Pre-Caspian Depression and Central Asia. It would also have serious--but not crippling--consequences for operations in West Siberia. Where operations were not halted by a lack of Western technology and equipment, the myriad of inefficiencies associated with the use of domestically manufactured obsolescent equipment of poor quality would boost production costs and tend to reduce the percentage of oil in place that ultimately will be recovered. 25X1

We judge that, even under the conditions indicated, the Soviet Union would be able to supply its own essential needs for oil, including those of the armed forces. Unilateral action by the United States would have limited impact. Concerted action by all COCOM members would slow many Soviet projects, raise their energy investment costs, and, in turn, impose costs on other sectors of the economy. It is possible that these added costs and delays could, if coupled with other considerations, promote tactical adjustments in Soviet foreign policy. But we do not believe these pressures would be sufficient to force basic changes in Soviet defense and foreign policies. 25X1

Although the sour oil and gas development projects in the Pre-Caspian Depression are highly vulnerable to denial of Western technology and equipment, Soviet gas production as a whole is not vulnerable because of the possibility of accelerated exploitation of the huge reserves of sweet gas in Northern Tyumen'. The USSR, moreover, is rapidly becoming self-sufficient in the components necessary for construction of long-distance gas transmission pipelines. We conclude that the USSR will be able to produce and offer for export large additional amounts of natural gas through the 1985-2000 period, so long as adequate supplies of large-diameter linepipe are available from the West or, especially in the latter part of the period from increasingly capable domestic pipemills. 25X1

The United States can offer unique state-of-the-art technology and equipment (e.g., for oil and gas exploration), but other COCOM countries have more-than-adequate capabilities. As a result, if present US/COCOM controls

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were lifted on all Western oil and gas technology and equipment but other aspects of US-Soviet relations did not improve noticeably, we would expect Moscow to continue to use West European and Japanese contractors and equipment where possible, limiting US participation to subcontracting through overseas subsidiaries and licensees. Even if US-Soviet relations were to improve substantially, US firms might not realize many immediate benefits because West European and Japanese banks offer better financial terms. [redacted] 25X1

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Western Energy Technology and Equipment As A Factor In Soviet Energy Prospects

Overview of Soviet Energy Development

Trends in Energy Production

Since 1960, output of primary energy--crude oil, natural gas, coal, hydroelectric power, nuclear power, and minor fuels--has tripled, but growth has been uneven among the major fuels. Coal was the main fuel for the national economy before the mid-1960s; by 1983, however, its share of primary energy production was only 22 percent (see figure 1). Oil output soared from 148 million tons in 1960 to 616 million tons in 1983, increasing its share in primary energy to nearly 41 percent. Natural gas production has grown even more rapidly, with output increasing elevenfold--from 45 billion cubic meters (m^3) in 1960 to 536 billion m^3, or 29 percent of primary energy, in 1983. In the past four years, coal production has stagnated and oil production has increased at less than 1 percent annually, while natural gas output has increased by 7 to 8 percent annually (figure 2). 25X1

The investment data in table 1 show the increasing share of industrial investment being devoted to energy production--up from 28 percent in 1975 to 35 percent in 1983. The data also reveal that the continuing emphasis on oil production has resulted in the allocation of nearly half of energy investment to the oil industry since 1981. The emphasis on oil has cut into the resources available for the coal and electric power industries, contributing to the stagnation of coal production and the marginal inadequacy of electric power supply. The burdensome nature of the oil production--and, to a lesser extent, coal production effort--is illustrated by the relationship of changes in investment and output between 1975 and 1983. Oil investment rose by 140 percent while oil output increased 26 percent; coal investment rose 35 percent while coal output increased by only 2 percent. The gas industry, however, presented a remarkable success story: investment up 50 percent and output up 85 percent. 25X1

Factors Affecting the Outlook for Primary Energy Production

Soviet energy production is affected by a host of problems related to the quality of exploitable resources, the quality and availability of equipment and technology, and the supply and utilization of skilled management and labor (table 2). 25X1

Although the USSR has oil reserves of some 50-70 billion barrels, the Soviet's attempt to sustain oil output at a high level is encountering serious difficulties and increasing costs reflecting:

- o Emphasis on production at the expense of exploration.
- o Increasing relaince on development of smaller fields with lower new-well flow rates.
- o Accelerating watering-out of existing wells.
- o Severe operating conditions in sub-arctic West Siberia.
- o Endemic equipment and labor supply problems. 25X1

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Table 1
USSR: Energy Investment in Relation to Total Industrial Investment[a]

Investment (billion 1973 rubles)

	Total Industry	Total Energy	Oil	Gas	Coal	Electric Power
1970	28.5	8.0	2.5	1.0	1.5	3.0
1975	39.7	11.0	3.8	1.8	1.7	3.7
1980	47.6	15.5	6.8	2.1	2.1	4.5
1981	49.5	16.6	8.1	2.0	2.0	4.5
1982	50.9	17.7	8.7	2.3	2.2	4.5
1983	53.7	18.7	9.1	2.7	2.3	4.6

Shares of Investment (percent)

	Energy Investment as a Share of Industrial Investment	Energy Sector Investment as a Share of Total Energy Investment[b]			
		Oil	Gas	Coal	Electric Power
1970	28.1	31.2	12.5	18.8	37.5
1975	27.7	34.5	16.4	15.5	33.6
1980	32.6	43.9	13.5	13.5	29.0
1981	33.5	48.8	12.0	12.0	27.1
1982	34.8	49.2	13.0	12.4	25.4
1983	34.8	48.7	14.4	12.3	24.6

[a] Excluding investment in natural gas pipelines, oil refining, and minor fuels production.

[b] Shares may not add to 100 because of rounding.

Table 2

Main Factors Affecting Energy Development

Energy Source	Reserve Quality	Technology and Equipment Needs	Labor and Infrastructure
Oil	o Quantity of West Siberian, Komi, Kazakhstan and offshore reserves could support production growth but quality problems present.	o More complicated, more corrosive deposits will require substantial amounts of Western equipment.	o Major management difficulties: shortages of skilled labor, high labor turnover, multiple projects requiring coordination and phasing. 25X1
	o Middle Ob' (W. Siberia) development affected by increasing depth of reservoirs with lower porosity, permeability, and flow rates.	o Development drilling equipment capable of operation at greater depths to produce oil and inject water. o Corrosion-resistant producing equipment.	o Remote production sites, most subject to arctic conditions: transportation and basic services problematical.
	o Komi development limited by arctic environment and the heavy and paraffinic oils.	o Enhanced oil recovery technology, equipment, and chemicals to boost recovery of heavy oils.	
	o Kazakh oils have various drawbacks: some are highly paraffinic, some are heavy, some have high sulfur and CO_2 content.		
	o Potential offshore (Barents, and Kara Seas, offshore Sakhalin and deeper Caspian), but exploration in early stages.	o Offshore arctic drilling and production platforms.	
Natural Gas	o Most reserves of high quality: potential well-flow rates among the highest in the world.	o Large-diameter linepipe, more efficient turbines and compressors, gas processing plants for sour gas.	o Largest reserves located in arctic regions of West Siberia: difficulties in production, transportation, and labor recruitment and retention. 25X1
	o Sour gas deposits in southern USSR offer tradeoff between location and production complexities.	o Corrosion-resistant equipment for drilling, well-completion and gathering systems, and processing natural gas.	

(Continued on next page)

(Table 2, continued)

Coal	o Depleted reserves west of the Urals.	o Thin-seam miners, underground transportation equipment.	o High wages needed to retain and to attract miners.
	o Large but poor quality reserves east of the Urals.	o Coal cleaning and enrichment plants and synfuels technology and plants.	o Harsh Siberian environment, little infrastructure, high labor turnover, labor shortages.
	o Shallow deposits east of the Urals can be surface mined.	o Off-road trucks, high-volume excavators and draglines.	
Nuclear Energy	o Uranium reserves sufficient for short to medium term.	o Nuclear power plant components: pipes, valves, pumps, control instrumentation.	o Program expansion planned for 1980s requires many new hires, training.
	o Ambitious breeder reactor construction plans assure long-term nuclear fuel supply.		o Most important component assembly plant, Atommash, requires major reconstruction.
Hydroelectricity	o River systems of European USSR largely developed.	o Already leaders in hydro turbine technology and dam construction	o Hydro expansion in East Siberia, Far East linked to exploitation of untapped raw material deposits.
	o Potential expansion limited to East Siberia, Soviet Far East.	o Construction equipment could be needed for rapid expansion of dam construction.	

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The USSR's reserves of natural gas--estimated at some 34 trillion m^3--comprise about 40 percent of world proved gas reserves and, in the Soviet context, are relatively accessible for rapid development. This generalization, of course, should not obscure the difficult arctic conditions under which the clean and relatively shallow Tyumen' gas deposits must be worked, or the dangers and technical problems associated with extraction and processing of the toxic and corrosive gas from deep deposits of the Pre-Caspian Depression. 25X1

Soviet coal reserves are huge--some 166 billion tons in terms of standard cost equivalent--but coal production has been held back by the depletion of the better-quality reserves in the Western USSR, the low energy content and remoteness of coal supplies from Kazakhstan and East Siberia, and investment policies that for many years have favored investment in oil development. The most urgent problems in Soviet energy development center on oil production, not the least because of oil's pre-eminence as an export commodity and source of hard currency. 25X1

The Role of Western Technology and Equipment

The USSR has achieved its present status as the world's leading producer of oil and natural gas largely through the use of domestically manufactured equipment. It has turned to the West for selected high-quality and state-of-the-art equipment and technology to obtain higher operating performance and reliable service, as well as to overcome shortages of key items and supply projects for which Soviet equipment is inadequate (e.g., sour gas development). In recent years the Soviets have undertaken a program to enhance both the quality and quantity of equipment manufactured domestically, and this effort will continue into the 1990s. Thus far, however, the inefficiencies of the Soviet economic system have hindered both the production of high-quality oil and gas equipment and the efficient use of advanced techniques and equipment acquired from the West. 25X1

During the 1970s the USSR purchased some $5 billion worth of Western oil and gas equipment. The impact of these imports was larger than their share in total Soviet oil and gas equipment supply would suggest, however, because the imported equipment was used to cover shortages in the USSR's own supplies or to cope with particularly difficult technical problems. Especially important among these acquisitions were:

- A turnkey plant to produce high-quality drill bits (from the United States).
- Gas-lift equipment for two major oilfields in West Siberia (from France, with key components from the United States).
- Assembly yards for producing offshore drilling platforms (from France).
- Large-diameter line pipe, pipelayers, and turbine-compressors sets for the gas pipeline network (from West Germany, Italy, France, Japan, and the United States).
- Equipment and chemical plants for enhanced oil recovery (EOR) projects (from the United States, France, Italy, and West Germany). 25X1

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Table 3

Soviet Imports of Oil and Gas Equipment from COCOM Countries, 1980-83, by Type of Equipment and Country of Origin

(million dollars)

Item	Source	1970	1975	1980	1981	1982	1983
Total		168.5	1,639.4	1,659.4	1,909.7	3,137.9	3,449.5
Machinery and equipment for geological exploration, drilling, well operation, and pipeline operation	Great Britain	5.9	2.0	26.6	31.0	88.7	120.3
	Canada	0.2	2.9	4.1	3.0	8.9	24.1
	United States	--	49.4	57.5	7.7	26.9	6.5
	FRG	--	48.0	1.4	27.4	110.5	396.4
	France	2.3	23.6	90.2	54.5	57.5	260.8
	Italy	--	12.1	--	5.7	126.1	357.4
	Japan	--	--	--	21.1	143.2	113.5
Subtotal		8.4	138.0	179.8	159.4	561.8	1,279.0
Pipe	Italy	0.6	375.9	223.7	280.1	442.0	383.7
	FRG	111.0	589.9	554.2	455.3	628.6	677.8
	France	14.1	158.1	158.5	122.8	148.6	92.0
	Japan	21.1	288.4	524.4	890.5	1,269.2	741.4
	Belgium	3.0	28.6	--	--	79.5	228.4
Subtotal		149.8	1,440.9	1,460.8	1,748.7	2,567.9	2,123.1
Oil refining equipment	Italy	1.0	1.2	0.9	1.2	1.2	0.7
	France	7.1	58.4	3.6	0.2	2.1	1.2
	Japan	--	--	13.2	--	--	--
	Great Britain	2.2	0.9	0.1	0.2	0.4	0.2
	FRG	--	--	--	--	4.5	45.3
Subtotal		10.3	60.5	17.8	1.6	8.2	47.4

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Purchases of Western oil and gas equipment (including pipe) have more than doubled since 1980 (see table 3). Purchases of all types of pipe and exploration and development equipment account for nearly all oil and gas-related equipment sales.[1] Oil refining equipment has accounted for only a very small percentage of imports from the West. Soviet purchases of Western oil and gas equipment are likely to drop following fulfillment of equipment supply contracts for the Siberia-to-Western Europe gas export pipeline. Soviet trade journals indicate that sales of gas pipeline equipment (including pipe) rose sharply in 1982 and accounted for about 85 percent of total sales of oil and gas equipment in 1982 and 1983. Although not of the magnitude of the export pipeline project, the sour oil and gas development projects in the Pre-Caspian Depression (notably Astrakhan' and Tenghiz) are providing new large contracts for Western (mainly French and West German) equipment suppliers. 25X1

In addition to sharply boosting COCOM-country exports of oil and gas equipment (excluding pipe and refining equipment) to the USSR, the supply contracts for the gas export pipeline resulted in substantial changes in the pattern of provenance. The major beneficiaries were West Germany and Italy; the major loser was the United States. In the pipe category, Japan and West Germany together supplied about two-thirds of the total in 1982-83, while sales by France declined. 25X1

Primary Energy Outlook for 1985-2000--Plans and Challenges

The Soviet long-term energy plan for the 1985-2000 period envisions major shifts in the national energy balance, with natural gas providing nearly all of the increment in total primary energy production into the 1990s. Accelerated development of nuclear power is to provide substantial additional energy in the 1990s and beyond. After a period of intensive preparation in the 1990s, coal is to become the dominant fuel in the USSR after 2000. 25X1

During 1985-2000, the share of natural gas in the primary energy balance is expected to expand rapidly; we estimate that it might reach about 40 percent in the mid-1990s, with oil's share shrinking to about 30 percent. Natural gas has already replaced oil as the chief incremental source of energy, and we believe that the Soviets can continue to boost gas output sharply, using existing domestic equipment and technology for the most part. Oil's share in the primary energy balance will decline as a result of gas-for-oil substitution and likely slippage in oil production. 25X1

<u>Oil</u>. The major energy supply problems through 2000 are expected to arise in the oil industry, where current long-range plans for maintaining high levels of output are in jeopardy. The focus of the Soviet exploration and development effort will shift to deeper and more complicated onshore and offshore deposits. Onshore, deeper exploration and development will require greatly improved seismic, drilling, and production equipment to cope with more complex geologic conditions. Deep formations in the Pre-Caspian Depression will require state-of-the-art high-pressure, high-temperature, corrosion-resistant equipment. Offshore, Soviet equipment is inadequate to develop

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[1] The foreign trade category "pipe" includes, *inter alia*, large-diameter pipe and oil-country tubular goods (drill pipe, well casing, etc.).

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oilfields in deep-water and arctic environments. Without a rapid infusion of state-of-the-art offshore exploration and production technology and equipment, Soviet oil output could face more rapid decline in the 1990s. 25X1

Gas. Gas output in the key West Siberian region is expected to rise steadily through 2000 with few foreseeable problems or major obstacles to overcome. The Soviets will likely rely--albeit to a decreasing extent--on some imports of Western linepipe, valves, and controls for expansion of the natural gas pipeline network and for realization of plans to substitute gas for fuel oil. The rapid growth of gas output will require ongoing investment in gas treatment plants and in gas transmission pipelines. Operational efficiency would be substantially enhanced by the use of Western equipment. To develop the sour gas fields and recover natural gas liquids at Astrakhan' and Karachaganak, the USSR will import corrosion-resistant, high-pressure-and-temperature production, processing, and transport equipment. 25X1

Coal. Coal output has remained essentially unchanged since peaking in 1978. To maintain output at the current level, the Soviets will need to increase production from the Eastern coal basins to offset declining output at mines in the European USSR. 25X1

Efforts to boost coal production to planned levels will prove difficult. The Soviets could opt for slurry pipelines to improve coal transportation efficiency or for plants to convert coal into gas and liquid fuel. There is some official interest in producing methanol from natural gas and using the methanol as the vehicle for pipelining pulverized coal from Siberian deposits into the Western USSR for domestic use or export. 25X1

The long-range goal of a major expansion in coal production is unlikely to be accomplished without some Western assistance. Imported equipment and technology will probably have a key role in Soviet efforts to meet goals for building slurry pipelines, rapidly expanding surface mining, and producing synthetic fuels from coal. The Soviets already are negotiating with Western firms on technology and equipment for these applications. 25X1

Nuclear Power. The Soviet nuclear power industry has depended even less than the oil and gas industries on imports from the West to upgrade its technology. Western suppliers to the USSR's nuclear industry did help to ease a major bottleneck, namely the shortage of manufacturing capacity for reactor components and equipment. But although foreign equipment is generally more reliable and of higher quality than that usually provided by Soviet domestic producers, no prospective major nuclear project is apt to involve sizable imports of Western technology and equipment. 25X1

Long-term objectives of the nuclear program require construction of eight times more power plant capacity than are now on line. In addition, the Soviets hope to launch a new generation of nuclear plants dedicated to centralized space and process heating in cities. Moscow thinks that these objectives can be achieved utilizing Soviet and CEMA resources, and the CEMA client states have been promised a share of the output from jointly developed nuclear projects. 25X1

Hydroelectric Power. As a world leader in the design and production of hydroelectric equipment, the USSR will probably not need Western help for

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continued development. Soviet long-range plans envision only slow growth for hydroelectric power production until projects to tap raw materials in East Siberia and the Far East are launched. 25X1

Technology and Equipment Requirements for the Oil and Gas Industries

General Adequacy of Indigenous (Soviet and East European) Technology and Equipment

The technology and equipment needed by the USSR for most of its major development projects are currently available in the USSR and East European (Warsaw Pact) countries (see column 1 of table 4). Nonetheless, we rate the quality and technical characteristics of Warsaw Pact output of nearly all of the items listed are rated only low to adequate by Western standards, meaning that they are suitable for most current needs but will be increasingly inadequate (often in the sense of being inefficient and uneconomic) for future requirements. Thus an inefficient piece of equipment, though capable of marginal performance of a task (under conditions in which no constraints exist on the time, manpower, and ancillary resources used), may be considered inadequate. This concept of inadequacy is increasingly applicable to Soviet exploration and producing equipment in view of the escalation of drilling requirements in the face of limited availability of skilled manpower and technical support. 25X1

Changes in production schedules, improvements in metallurgy, and introduction of new methods of metal-working for new or improved equipment production at existing Soviet and East European plants usually proceed at glacial speed. Therefore, construction of new plants dedicated to the production of selected new equipment often proves to be the fast track for implementing desired technological change over a 5- to 8-year period. If the defense-production industries are involved, lead times probably can be reduced materially, however. 25X1

Specific Applications of Foreign Technology and Equipment in 1985-2000

Oil and Gas Exploration.

a. Applications.--Because of the huge base of onshore natural gas reserves already discovered and the tenuous relation between the size of developed oil reserves and the targeted rate of oil production, the greatest demands will be made on exploration for oil. Barring the discovery of a "second Samotlor," new oil in the USSR will probably be found in deeper, smaller, geologically more complex formations and, possibly, increasingly offshore. Efficient exploration under these conditions calls for quality equipment embodying high technology. 25X1

b. Indigenous Capability.--Soviet exploration technology and equipment is rated low by Western standards. Although Soviet scientific "know-how" is more than adequate, the use of poor equipment limits efficiency and hinders progress in exploration. Some Hungarian and Romanian items of equipment have slightly better capabilities than the Soviet counterparts. Because many of the advanced exploration techniques rely heavily on state-of-the-art computer technology (a field in which the Soviet Union substantially lags the West), there is little prospect of rapid improvement in indigenous capabilities in exploration equipment. 25X1

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c. Western Availability.--State-of-the-art exploration technology is available in the United States, France, and the United Kingdom; the remaining COCOM countries possess high-level capability (see table 4 and the appendix table). Adequate technology is available in Austria and several Latin American countries. The United States has state-of-the-art capability for producing most types of exploration equipment, and Canada, France, and the United Kingdom have high capability. The remaining COCOM nations have capabilities that are adequate or less than adequate for current needs but probably would not be adequate for future Soviet needs. Latin American and non-COCOM Asian suppliers have no demonstrated ability to produce advanced exploration equipment. 25X1

Oil and Gas Drilling and Production

a. Application.--With the bulk of the Soviet oil and gas drilling and production effort located in the central and northern reaches of West Siberia, operations are already difficult because of climate, terrain, and the impact of remoteness on logistical support. In 1985-2000, operating problems in West Siberia will multiply as drilling requirements spiral upward because of increasing well depths and the greater number of wells required to compensate for low new-well flow rates. More pumping will be required, and the number of well repairs will rise dramatically. The increasing exploration of the "sour" oil and gas resources of the Pre-Caspian Depression and Central Asia involves substantially greater depths and high pressures and temperatures. In addition, drillers have to cope with the toxic and corrosive hydrogen sulfide (H_2S) and carbon dioxide (CO_2) present in the deposits. Offshore activity in the Caspian Sea will require platforms and equipment capable of operating in waters much deeper than those explored in the last decade. If deposits suitable for exploration are found in the Barents and Kara Seas, arctic ice conditions will pose challenges probably more severe than those offshore from Sakhalin. 25X1

Under the conditions foreseen, the quality of both the technology and equipment available become paramount considerations. As the length of the drill string, column of production tubing, or casing increases, the importance of high-quality steels and quality control in the fabrication of oil-country tubular goods rises exponentially. In working sour oil and gas deposits, corrosion resistance and reliability are essential. The need in some cases to contain extreme pressures clearly suggests a requirement for high-quality production equipment. When many of these requirements are superimposed on the complicated task of operating offshore in deep waters (perhaps with ice conditions), questions relating to compatibility of systems must be added to those of quality and individual levels of technology. 25X1

b. Indigenous Capability.--Soviet drilling and production technology, as well as the ability to produce related equipment, are rated low. Romania and Hungary have slightly better capability to provide these items, but neither country produces a sufficient volume of equipment to meet Soviet needs. None of the Warsaw Pact countries possesses more than low capability for offshore operations or for deep sour oil and gas development under high-pressure and high-temperature operating conditions. The Soviets may be able to improve their technology somewhat, but the outlook for marked improvement in equipment for large-scale use is dim. The lack of special alloys and the quantities needed, indifferent quality control, and lack of responsiveness of equipment producers to the needs of operators are likely to continue. 25X1

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Table 4

Quality and Availability of Oil and Gas Equipment, by Major Area of Provenance

Production Capability Code:

X = Highest, or state-of-the-art capability
Hi = More than adequate for needs
A = Adequate for most needs
Lo = Some capability, but inadequate for most needs
O = No demonstrated capability
Blank = Unknown

Note: The 22 items covered by US foreign policy controls and proposed for COCOM control are subsumed in the categories included in Section A (Exploratory Technology and Equipment) and Section B (Drilling and Production Technology and Equipment) of this table. Except for certain turbines, the items covered by Section C (Pipeline Construction Technology, Materials, and Equipment) and Section D (Gas Processing and Oil Refining Technology and Equipment) are not subject to US controls.

Source: Analysis of data from Composite Catalog of Oil Field Equipment and Services 1984-85, published by Gulf Publishing Company.

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ITEM	WARSAW PACT	USA	COCOM	NON-COCOM WESTERN EUROPE	THIRD WORLD
A. EXPLORATION TECHNOLOGY AND EQUIPMENT					
1. Exploration Technology (all phases)	**Lo**	**X**	**Hi-X**	**O-A**	**O-A**
a. Project Feasibility and Management Studies	Lo	X	Hi-X	O-A	O-A
b. Technical integration of Hardware and Software	Lo	X	Hi-X	O-Lo	Lo-A
2. Exploration Geophysical Equipment (all types)	**Lo**	**X**	**A-Hi**	**Lo**	**O-Lo**
a. Seismic Survey Vessels (equipment package - excluding hull and boat)	Lo	X	A-Hi	Lo	O-Lo
b. Satellite Navigation Equipment	Lo	X	Hi	Lo-Hi	O-Lo
c. Acoustical/Ultrasonic Sensors and Geophysical Equipment:					
(1) Geophones for Onshore and Offshore Seismic Surveying	Lo	X	O-Hi	O	O-Lo
(2) Land Gravimeters	Lo	X	O-Hi	O-X	O-Lo
(3) Magneto-Telluric Systems	Hi				
(4) Well Logging Equipment	Lo	X	O-Hi	O	O-Lo
(5) Mud Logging Equipment	Lo	X	O-Hi	O	O-Lo
(6) Monitoring Equipment for Drilling Operations (Mud Systems) and Drill Stem Testing Equip.	Lo	X	O-Hi	O	O-Lo
(7) Computer Hardware	Lo	X	A-Hi	O	O-Lo
B. DRILLING AND PRODUCTION TECHNOLOGY AND EQUIPMENT					
1. Production Technology (all phases)	**Lo**	**X**	**Hi**	**O-Hi**	**A-Hi**
Of which:					
a. Project Feasibility and Management Studies	Lo	X	Hi	O-Hi	A-Hi
b. Technical Integration of Hardware and Software	Lo	X	Hi	O-Hi	A-Hi
2. Production Equipment (all types)	**Lo**	**X**	**Lo-Hi**	**O-A**	**O-A**
a. Corrosion Resistant Producing Equipment (all types)	Lo	X	Lo-Hi	Lo-A	O-Lo
(1) Christmas Trees and Blow-out Preventers	Lo	X	A-X	O-A	O-Lo
(2) Remote Control Systems	O-Lo	X	O-X	O-A	O-Lo
(3) Well heads	Lo	X	A-Hi	O-Hi	O-Lo
(4) Special Steel Tubes-Casing, Tubing, Drill Collars, Drill Pipe	Lo	X	O-Hi	O-Hi	O-Hi
(5) Packers, Seals, Valves	Lo	X	O-Hi	O-Lo	O-A
(6) Pump Rods	Lo	X	O-Hi	O-Hi	O-A
(7) Deep Submersible Pumps (below 600 m. depths)	Lo	X	O-A	O	O
(8) Manifold Systems	Lo	X	Hi-X	Lo-Hi	O-Hi
(9) Chemical Inhibitors	Lo	X	Hi-X	O-Hi	O-A
b. High Pressure-Temperature Production Equipment (all types)	Lo	X	Lo-Hi	O-Lo	O-Lo
(1) Christmas Trees and Blow-out Preventers	Lo-A	X	Lo-X	O-A	O-Lo
(2) Remote Control Systems	O-Lo	X	A-X	O-A	O-Lo
(3) Wellheads	A	X	Lo-Hi	O-A	O-Hi
(4) Casing and Tubing	Lo	X	Lo-X	O-Hi	O-Hi
(5) Packers, Seals, Valves	Lo	X	O-A	O-Lo	O-A
(6) Deep Submersible Pumps (below 600 m. depths)	Lo	X	O-A	O	O
c. Deep Well Drilling Rigs and Tools (below 3000 m. depths onshore and offshore)	Lo-A	X	Hi	O-Hi	O-Hi
(1) Offshore Drilling Platforms	Lo	X	Hi	O-A	O-Hi
(2) Measuring Instruments and Control Systems	Lo	X	Lo-Hi	O-A	O
(3) Riser and Motion Compensation Systems	Lo	X	Hi	O	O
(4) Dynamic Positioning Systems	Lo	X	A-Hi	O	O
C. PIPELINE CONSTRUCTION TECHNOLOGY, MATERIALS, AND EQUIPMENT					
1. Pipeline Technology (all phases)	**A**	**X**	**Hi-X**	**O-A**	**O-A**
a. Project Feasibility and Management Studies	A	X	Hi-X	O-A	O-A
b. Technical Integration of Hardware and Software	A	X	Hi-X	O-A	O-Lo
2. Pipeline Materials and Equipment (all types)	**Lo**	**X**	**Hi-X**	**O-Lo**	**O-Lo**
a. Large Diameter Pipe (1020-1420mm diameter pipe)	Lo	Hi	Hi-X	O-Hi	O
b. Pipe Wrapping and Coating Materials	Lo	X	A-X	O-Lo	O
c. Large Diameter Valves (1020-1420mm bore)	Lo-A	X	A-X	O	O
d. Pipeline Control Systems	Lo	X	Hi-X	O	O
e. Turbine Drivers and Compressors	A	X	Hi-X	O-Hi	O
f. Heavy Duty Pipelayers (over 50-ton load capacity)	A	X	O-X	O	O
D. PROCESSING AND REFINING TECHNOLOGY AND EQUIPMENT					
1. Technology (all phases)	**Lo-A**	**X**	**X**	**A-Hi**	**Lo-Hi**
a. Project Feasibility and Management Studies	Lo-A	X	X	A-Hi	Lo-Hi
2. Processing and Refining Equipment (all phases)	**Lo-A**	**X**	**X**	**Lo-A**	**Lo-Hi**
a. Fluid Catalytic Cracking (FCC)	Lo-A	X	X	Lo-A	Lo-Hi
b. Hydrocracking	O-Lo	X	Lo-Hi	Lo-A	Lo-Hi
c. Reduced Crude Cracking (alternative to FCC)	O	X	O-X	O	O-Lo
d. Hydroprocessing	Hi	X	X	Lo	Lo-A
e. Delayed Coking and Fluid Coking	Hi	X	Hi	Lo	O-A
f. Catalytic Reforming	A	X	X	A	Lo-A
g. Hydrogen Fluoride Alkylation	O	X	O-A	O	O
h. Equipment for Production of Additives for Lubes	Lo	X	Hi-X	A	O-Lo
i. Gas Processing Plants	Lo	X	Hi	O	O-A

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c. Western Availability.--State-of-the-art drilling and production technology is available in the United States; most other COCOM countries, as well as Austria, Brazil, Mexico, Venezuela, and Singapore, can provide high-level technology. Argentina, India, Peru, and Taiwan can provide adequate technology. The United States can produce state-of-the-art high pressure-temperature, corrosion-resistant drilling and producing equipment required for severe service, and several other COCOM countries have high capability to produce some, but not all of these items. Elsewhere the ability to produce the majority of these items is quite low. 25X1

Pipeline-Construction Technology, Materials, and Equipment

a. Application.--Substantial replacement, but little expansion, of the USSR's oil pipeline system is likely over the next sixteen years. The long-distance gas transmission pipeline system will continue to grow, probably at an average rate of roughly one new 1,420-mm diameter, 75-atmosphere pipeline annually. Some additional problems will arise, associated with the low ambient temperatures and more severe permafrost conditions that will be encountered as gas production moves north from Urengory to Yamburg and, later, to the Yamal Peninsula. Most of the problems facing the Soviet gas pipeline industry relate to increasing the efficiency of the system through introduction of improved technology (much of it requiring enhanced computer hardware and software capabilities) and the introduction of more reliable and efficient equipment. 25X1

b. Indigenous Capability.--Soviet arctic pipeline construction technology is adequate for most current oil and gas needs and superior to that available in Eastern Europe. None of the Warsaw Pact countries have demonstrated any capability to match Western offshore pipeline construction. Soviet pipeline material and equipment are adequate for most oil pipeline needs. In the past, the USSR has had very little capability to produce large-diameter pipe for the gas pipeline. Limited capability to manufacture this pipe has been established, however, in recent years, and the USSR is trying to expand production of pipe suitable for high pressure gas pipeline service. East European capability to produce these items is even more limited. 25X1

Linepipe imported from the West accounted for 80 to 90 percent of some 34,000 kilometers of 1,420-mm diameter gas pipeline laid in the USSR through 1984. Acutely aware of the pipe-quality problem--having had to import over 16 million tons of large-diameter (1,020-1,420 mm) linepipe--the USSR has undertaken domestic production of linepipe. At this time, it appears that a limited production capability has been achieved by a spiral-weld multilayer process and by longitudinal welding along two seams of pipe formed from steel plate. Although these processes offer the prospect of a usable product, the Soviet pipe will not combine strength and ease of handling as efficiently as pipe available in the West. 25X1

During 1986-90, the USSR will probably also be much less dependent on the West for gas turbines than in the past, largely because of increased domestic turbine production and a somewhat slower pace of construction of large-diameter gas pipelines. Faced with the prospect that the US embargo would delay delivery of the Western gas turbines ordered for the gas export pipeline, the Soviets initiated a crash program during 1982-83 to produce 16- and 25-megawatt (MW) turbines. We estimate that Soviet industry increased its

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production of gas turbines suitable for large-diameter pipelines from about 1,100 MW in 1981 to 2,600 MW in 1983. During 1983-84, the Soviets contracted to purchase an additional 21 Western Frame V 25 MW turbines from the Italian firm Nuovo Pignone, but this represents only about 10 percent of estimated demand during 1984-85 for large gas turbines. [redacted] 25X1

The new effort to produce turbines for large-diameter pipeline service entailed a shift in emphasis toward use of aeroderivative turbines. [redacted] 25X1 [redacted] in 1984 the Soviets have installed substantial numbers 25X1 of 16-MW aeroderivative gas turbines on major domestic gas pipelines. We estimate that aeroderivatives account for about 30 percent of current Soviet production of turbines suitable for use on large-diameter gas pipelines. [redacted] 25X1

Gas turbines produced by the USSR's civilian industry have never equaled Western turbines in quality and efficiency. We believe, however, that the new Soviet 16- and 25-MW gas turbines, despite their probable lower efficiencies and (at least initially) poor reliability, are workable--if imperfect--substitutes for Western turbines. [redacted] 25X1 During the first years of operation, Soviet turbines are likely to have a high incidence of failure. As the problems causing these shutdowns are corrected, the reliability of the Soviet turbines (measured as the average time to unscheduled shutdown) will probably improve. [redacted] 25X1

Other equipment and materials.--The USSR, which has purchased over 5,000 heavy-duty pipelayers from the West since 1970, reportedly has had some measure of success in producing a pipelayer capable of handling 1,420-mm diameter pipe. This pipelayer, however, may not be suitable for use under arctic conditions. Soviet metallurgy for critical engine parts and Soviet lubricants are usually inadequate for operation in extremely cold conditions. This leads to short engine life and undependable performance. Ministry of Gas officials have indicated that the USSR will probably import about 2,000 pieces of heavy equipment for gas pipeline construction (pipelayers, bulldozers, and tractors) during 1986-90. The level of heavy-equipment orders during 1986-90 will probably be somewhat lower than during 25X1 1981-85. (The USSR imported about 2,000 pieces of heavy equipment [redacted] during 1981-82.) 25X1 To enhance the reliability and efficiency of the pipeline system, the USSR has also purchased several pipeline control systems, as well as large quantities of pipeline valves and pipeline coating and wrapping materials. [redacted] 25X1

Western Availability.--State-of-the-art pipeline technology is available from the United States and Canada; high-level technology, from other COCOM countries. Adequate technology is widely available outside COCOM from Austria, Argentina, Brazil, Mexico, Venezuela, India, and Singapore. State-of-the-art and high-level pipeline equipment and materials are generally available from the larger COCOM countries (see appendix table for specific items). [redacted] 25X1

State-of-the-art pipeline materials and equipment for arctic and offshore installation are available from the United States and, for most items, from Canada. West Germany, Italy, Japan, and France have exported most of the

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large-diameter linepipe, turbine-compressors, valves, and pipeline control systems to the USSR. The United States and Japan have supplied pipelayers, with Japan filling nearly all orders since 1980. Sweden has sold some large-diameter linepipe. In addition to the major Western countries, Sweden and Switzerland produce gas turbines for pipeline and industrial service. Several Latin American oil-producing countries, along with India and Singapore, have some technical capability but produce little if any of the materials and equipment. 25X1

Oil-Refining and Gas-Processing Technology and Equipment

a. Applications.--In contrast to the past, when the Soviets could simply increase crude-oil production and primary distillation at refineries to obtain a larger supply of gasoline and other light products, the 1985-2000 period will require expansion of secondary refining capacity to extract more light product from each barrel of crude oil, primarily by cracking mazut (residual fuel oil). The crude oil supply is likely to fall off while the domestic demand for gasoline, jet fuel, and diesel fuel continues to rise. Moreover, the demand for mazut is expected to decline as gas and, ultimately, coal replace it as boiler fuel. Meanwhile, oil exports will remain the most reliable source of hard currency. 25X1

The prospect for expansion of secondary refining is influenced by several additional factors. Depending on oil-market conditions in the West, mazut released from electric-power and industrial use in the USSR as the result of fuel substitution and conservation measures may be exportable to supply the expanded secondary refining capacity of Western refineries. To the extent that exports of mazut can satisfy hard currency needs, the crude oil that otherwise would have been exported can be processed through the primary refining stills to yield added supplies of light products. Moreover, the projected large increases in Soviet natural gas production will boost the supply of gas condensate, which, when pipelined to refineries together with the crude oil, will result in a somewhat lighter product mix from primary distillation. While these factors suggest the possibility of less need for added secondary refining capacity, the Soviet long-term energy plan refers to the use of methanol and synthetic fuel to help meet the demand for liquid fuels. This reference suggests strong pressure on the supply of light products and the need for deeper refining of the available oil supply. 25X1

The continued rapid increase in natural gas production will require concommitant construction of gas processing plants. The natural gas in northern Tyumen' is relatively clean and dry, although the average natural-gas-liquid content will increase somewhat as "pay zones" at different depths are exploited. Processing requirements in Tyumen' will remain relatively simple. The technology and equipment requirements for processing gas from deposits in the Pre-Caspian Depression and Central Asia are, however, of a much higher order because of the toxic and corrosive properties of the gas. 25X1

b. Indigenous Capability.--The USSR, taking into account imports from Eastern Europe, has generally been self-sufficient with respect to most of the primary and secondary processing equipment installed in its oil refineries. 25X1

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Soviet industry, however, has had serious difficulty in producing hydrocracking equipment (used for the processing of heavy feed stocks into a wide range of lighter hydrocarbon fuels) and hydrogen-fluoride alkylation equipment for the production of high octane gasoline. Hydrocracking technology would allow the USSR to process larger amounts of fuel oil (suitable primarily only for use in electricity- and heat-generating plants) into more valuable light products such as gasoline, kerosine, and diesel fuel. Under proper operating conditions, hydrocracking permits concentration on the output of any one of the light products and provides greater flexibility in range of output than catalytic cracking. Attempts by the USSR to duplicate a commercial hydrocracker built for a Soviet refinery by a French firm during 1974-75 have been unsuccessful to date. The sulfuric acid akylation technology used in the USSR can produce the alkylate required, although hydrogen fluoride alkylation technology would be more efficient. 25X1
25X1

The USSR has built fluid catalytic cracking (FCC) units but the FCC processes only the more easily cracked feedstocks. Moreover, only two of the FCC units have been built since 1977. An accelerated pace of construction would probably require Western assistance. 25X1

On average, Soviet <u>technology</u> and <u>equipment</u> for gas processing are rated low in relation to future needs. The USSR has demonstrated the ability to construct plants that can process the relatively clean gas from the northern Tyumen' deposits, but even there it has relied to some extent on imported equipment for specialized uses such as refrigeration. The story is quite different with respect to the sour gas deposits of Orenburg, the Pre-Caspian Depression, and Central Asia. After attempts in the late 1960s to develop the Central Asian gas fields with domestic equipment took a severe toll in terms of blow-outs and accidents involving H_2S, the Soviets turned to the West for technology and equipment for producing and processing sour gas. 25X1

<u>Western Availability</u>.--In the West, oil refining <u>technology</u> is available at a state-of-the-art level from all of the larger COCOM countries, and at a high level from Austria and Singapore. An adequate level of refining technology is widely available from Latin American and non-COCOM Asian countries. The larger COCOM countries also offer state-of-the-art refinery <u>equipment</u>, although not all countries produce all types of equipment. Firms in Japan, France, West Germany, the United Kingdom, and Canada can provide the technology and equipment for the hydrocracking process. Outside the United States, there is some capability in Canada and Western Europe to manufacture equipment and install the hydrogen fluoride alkylation process. Singapore has high overall capability for refinery equipment, while the capability of most of the other sources is low. There are exceptions: Mexico and Venezuela offer high capability in fluid catalytic cracking. 25X1

With respect to gas processing plants, state-of-the-art capability resides in the United States. The other large COCOM countries can supply high-level equipment; and Mexico and Venezuela, adequate equipment. At present, technology and equipment for the major Soviet sour oil and gas development projects in the Pre-Caspian Depression are being purchased largely from French and West German firms. 25X1

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[redacted] 25X1

Technology and Equipment for Coal Production and Transportation

Adequacy of Indigenous Technology and Equipment

Soviet long-range planning for the coal industry is based on a major expansion of open-pit operations, finding new solutions to the problem of long distance transportation, and developing a synfuels industry. The Soviets hope to be largely self-sufficient in surface-mining equipment, but until the heavy equipment plant at Krasnoyarsk goes into full production in the late 1980s Moscow will continue to purchase from East Germany and from Western suppliers. [redacted] 25X1

The Soviets propose to solve the coal transportation problem with long-distance coal-slurry pipelines. They are also developing ultra-high-voltage (UHV) electricity transmission capabilities so that power can be sent from coal-burning plants east of the Urals to consumers in the western USSR. Soviet research has achieved progress in UHV-transmission technologies but only rudimentary steps toward commercial application of slurry pipeline transport. [redacted] 25X1

The USSR synfuels research program has focused on development of two technologies: a pyrolysis process and a direct coal-conversion process that yields synthetic liquid fuels. The Soviets probably will not need substantial Western technical assistance to construct commercial coal pyrolysis facilities; a commercial demonstration plant using the pyrolysis process was completed in 1983. On the other hand, the Soviet effort to improve the Bergius direct-conversion process--a technology pirated from Germany at the end of World War II--has met with only limited success. [redacted] 25X1 If the USSR decides to build a commercial direct conversion facility during the 1990s, we believe that substantial Western assistance in technology and equipment would be required. [redacted] 25X1

Needs for 1985-2000

Surface Mining Equipment. The Soviets plan to expand open-pit coal mining from 40 percent of total production in 1983 to 60 percent of the total volume in the year 2000. Developing large, new mines will require surface mining equipment, produced in large quantities. Although the Soviets and East Germans have heavy equipment production capabilities on line or under construction, Western sources will still be needed to supply dump trucks of 100-ton capacity and larger, as well as power shovels, draglines, and bucket-wheel excavators each capable of moving millions of tons per year of rock overburden or coal. [redacted] 25X1

Coal-Slurry Pipelines. The USSR plans to build a 250-km coal-slurry pipeline between Belovo and Novosibirsk during 1986-90. The USSR is negotiating with West German, Italian, and Japanese firms to acquire necessary technology and equipment. If the Belovo-Novosibirsk pipeline proves the economic and operational feasibility of coal-slurry pipeline transport of Kuznetsk coal, the Soviets may undertake the construction of one or more long-distance, large-capacity coal slurry pipelines from the Kuznetsk basin to the Urals and Center regions. Soviet press statements report that these pipelines

[redacted] 25X1

would each have a capacity of about 20-25 million tons per year. We believe that the USSR would probably need technical assistance in designing and building the slurry preparation facility, the slurry pumps, and the facility for production of chemical additives. The Soviets could also purchase equipment for slurry lines. 25X1

<u>UHV Electricity Transmission</u>. Current Soviet planning calls for the construction of power lines of 1,150 kilovolts (kV) alternating current and 1,500 kV direct current. electricity 25X1 transmission, power lines of even higher voltages will be needed to complete various coal projects. Western experts in power transmission consider Soviet abilities in UHV transmission to be state-of-the-art in many respects. Nevertheless, the Soviets have not mastered all phases of UHV research and have problems putting their proven designs into production. For example, development of UHV circuit-breakers and switches continues to lag, as does development of thyristor rectifiers and converters for UHV direct-current applications. The Soviets do not have adequate production capacity for transformers, cable for the main conductors, and insulators for 1150 kV alternating-current power lines. Some US, French, and Swedish firms are leaders in UHV transmission technology and could assist the Soviets both in research and production of UHV transmission equipment. 25X1

<u>Coal-Cleaning Plants</u>. A major impediment to the expansion of output at a key basin, Ekibastuz, is the low quality of the coal. Since Ekibastuz coal is 40 percent ash (noncombustible matter), using this fuel directly in boilers--even specially designed boilers--causes frequent shutdowns of power plants. Early this year, the Soviets turned to West German and Italian companies for help on the coal-quality problem. The firms, Wesserhuette and Italimpianti, have agreed to provide the Soviets with technology and equipment for coal-cleaning plants at Ekibastuz. Additional multimillion dollar contracts for these companies or other firms are possible, given the ambitious expansion plans for Ekibastuz. 25X1

<u>Synfuels</u>. The Soviet Union is now building a 5-ton-per-day (input) direct-conversion pilot plant (with an output of 1.25 tons per day of synthetic liquids) at a coal mine near Moscow. If this process--an upgraded version of World War II vintage German technology--proves workable, the Soviets plan to build a 75-ton-per-day (input) liquefaction facility. Some Soviet energy specialists believe that various coal-liquefaction approaches need to be studied before processes are selected for full-scale commercial plants. 25X1

In the near future, the Soviets will probably look for western firms willing to underlap joint design and feasibility studies of coal liquefaction technology. Most of the proven technology in direct conversion with pilot-plant operating capacities greater than 5 ton per day (coal) originated in the United States. The West German firms Ruhrkohle and Veba operate the only significant direct-conversion plants located outside the United States. Ruhrkohle is also a sponsor of two processes developed in the US--EDS and H-Coal--and as a sponsor, Ruhrkohle has rights to the technology. Soviet equipment purchases for a synfuels industry are unlikely in the near term because the USSR does not plan to build commercial-scale liquefaction facilities until after 1990. 25X1

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Technology and Equipment for Nuclear Energy Development

Adequacy of Indigenous Technology and Equipment

Moscow's long-term objectives for the year 2000 in nuclear energy are to have online about 160,000 MW of power generating capacity (20,000 MW were operating by year-end 1983) and 60 to 100 plants using nuclear reactors to produce centralized heat. Soviet and East European planned expansion of capacity for nuclear-component production and assembly is supposed to provide for the major growth in the nuclear program. Nevertheless, selected component purchases from Western vendors could (as they have in the past) help to ease bottlenecks in equipment supply. 25X1

Needs for 1985-2000

Planned growth in the Soviet nuclear program is largely based on exploiting standardized designs for existing 1,000-MW pressurized water reactors and streamlining construction techniques. There would, however, need to be considerable improvement in the USSR's ability to manufacture component and build plants for the Soviets to meet the ambitious plans on their own. Purchases from the West of components for nuclear power plants such as stainless steel pipe, pumps, and valves would avoid some construction delays. The Soviets are less likely to find applications for technology imports from the West because of the differences between the Western and Soviet commercial nuclear development. Still, imports such as computer software for safety-related evaluations and instrumentation for monitoring reactor conditions could assist the Soviets in areas where the Soviet and Western nuclear industries are converging. 25X1

Technology and Equipment for Hydroelectric Power Production

Adequacy of Indigenous Technology and Equipment

Soviet planning to the year 2000 foresees only gradual growth of hydroelectric power, and existing indigenous manufacturing capability should be able to accomodate the planned expansion. The Soviets are among the world leaders in hydroelectric dam design and in the production of water turbines and associated electrical equipment. 25X1

Needs for 1985-2000

If the Soviets decided to accelerate hydroelectric power construction above currently planned levels, the growth could be constrained by insufficient dam excavation equipment. In this case, Western suppliers of large-scale, off-road equipment could be tapped to ease this constraint. 25X1

The Potential for Affecting Soviet Energy Development by Use of Export Controls

Western Items Most Vital to Planned Soviet Oil and Gas Projects

As the USSR addresses the increasingly difficult challenges facing its energy industries in 1985-2000, it will probably seek Western technology and equipment to cope with a broad range of projects (see table 5). The efficient

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Table 5

Soviet Needs for Western Oil and Gas Equipment and Technology for Key Projects, 1985-2000

Production Capability Code:

X = Highest, or state-of-the-art capability
Hi = More than adequate for needs
A = Adequate for most needs
Lo = Some capability, but inadequate for most needs
O = No demonstrated capability
Blank = Unknown

Note: The 22 items covered by US foreign policy controls and proposed for COCOM control are subsumed in the categories included in Section A (Exploratory Technology and Equipment) and Section B (Drilling and Production Technology and Equipment) of this table. Except for certain turbines, the items covered by Section C (Pipeline Construction Technology, Materials, and Equipment) and Section D (Gas Processing and Oil Refining Technology and Equipment) are not subject to US controls.

Source: Analysis of data from Composite Catalog of Oil Field Equipment and Services 1984-85, published by Gulf Publishing Company.

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ITEM	WARSAW PACT Capability To Produce: USSR	WARSAW PACT Capability To Produce: EASTERN EUROPE	WESTERN EQUIPMENT AND TECHNOLOGY NEEDED (*) FOR KEY SOVIET OIL AND GAS DEVELOPMENT PROJECTS 1985-2000 — OFFSHORE: Barents Sea	OFFSHORE: Sakhalin	OFFSHORE: Caspian Sea
A. EXPLORATION TECHNOLOGY AND EQUIPMENT					
1. Exploration Technology (all phases)	Lo	Lo	*	*	*
a. Project Feasibility and Management Studies	Lo	Lo	*	*	*
b. Technical Integration of Hardware and Software	Lo	Lo	*	*	*
2. Exploration Geophysical Equipment (all types)	Lo	Lo	*	*	*
a. Seismic Survey Vessels (equipment package - excluding hull and boat)	Lo	Lo	*	*	*
b. Satellite Navigation Equipment	Lo	Lo	*	*	*
c. Acoustical/Ultrasonic Sensors and Geophysical Equipment:					
(1) Geophones for Onshore and Offshore Seismic Surveying	Lo	Lo	*	*	*
(2) Land Gravimeters	Lo	Lo	*	*	*
(3) Magneto-Telluric Systems	Hi	A			
(4) Well Logging Equipment	Lo	Lo	*	*	*
(5) Mud Logging Equipment	Lo	Lo	*	*	*
(6) Monitoring Equipment for Drilling Operations (Mud Systems) and Drill Stem Testing Equip.	Lo	Lo	*	*	*
(7) Computer Hardware	Lo	Lo	*	*	*
B. DRILLING AND PRODUCTION TECHNOLOGY AND EQUIPMENT					
1. Production Technology (all phases)	Lo	Lo	*	*	*
a. Project Feasibility and Management Studies	Lo	Lo	*	*	*
b. Technical Integration of Hardware and Software	Lo	Lo	*	*	*
2. Production Equipment (all types)	Lo	Lo	*	*	*
Of which:					
a. Corrosion Resistant Producing Equipment (all types)	Lo	Lo	*	*	*
(1) Christmas Trees and Blow-out Preventers	Lo	Lo	*	*	*
(2) Remote Control Systems	O	Lo	*	*	*
(3) Well heads	Lo	Lo	*	*	*
(4) Special Steel Tubes-Casing, Tubing, Drill Collars, Drill Pipe	Lo	Lo	*	*	*
(5) Packers, Seals, Valves	Lo	Lo	*	*	*
(6) Pump Rods	Lo	Lo	*	*	*
(7) Deep Submersible Pumps (below 600 m. depths)	Lo	Lo	*	*	*
(8) Manifold Systems	Lo	Lo	*	*	*
(9) Chemical Inhibitors	Lo	Lo	*	*	*
b. High Pressure-Temperature Production Equipment (all types)	Lo	Lo			
(1) Christmas Trees and Blow-out Preventers	Lo	A	*		*
(2) Remote Control Systems	O	Lo	*	*	*
(3) Wellheads	A	A	*	*	*
(4) Casing and Tubing	Lo	Lo	*	*	*
(5) Packers, Seals, Valves	Lo	Lo	*	*	*
(6) Deep Submersible Pumps (below 600 m. depths)	Lo	Lo	*	*	*
c. Deep Well Drilling Rigs and Tools (below 3000 m. depths onshore and offshore)	Lo	Lo	*	*	*
(1) Offshore Drilling Platforms	Lo	Lo	*	*	*
(2) Measuring Instruments and Control Systems	Lo	Lo	*	*	*
(3) Riser and Motion Compensation Systems	Lo	Lo	*	*	*
(4) Dynamic Positioning Systems	Lo	Lo	*	*	*
C. PIPELINE CONSTRUCTION TECHNOLOGY, MATERIALS, AND EQUIPMENT					
1. Pipeline Technology (all phases)	A	A			
a. Project Feasibility and Management Studies	A	Lo	*	*	*
b. Technical Integration of Hardware and Software	A	Lo	*	*	*
2. Pipeline Materials and Equipment (all types)	Lo	Lo			
a. Large Diameter Pipe (1020-1420mm diameter pipe)	Lo	Lo	*		
b. Pipe Wrapping and Coating Materials	Lo	Lo	*	*	*
c. Large Diameter Valves (1020-1420mm bore)	Lo-A	Lo	*	*	*
d. Pipeline Control Systems	Lo	Lo	*	*	*
e. Turbine Drivers and Compressors (Aeroderivative; turbines)	A	Lo	*	*	*
f. Heavy Duty Pipelayers (over 50-ton load capacity)	A	Lo			
D. GAS PROCESSING AND OIL REFINING TECHNOLOGY AND EQUIPMENT					
1. Technology (all phases)	Lo	A			
a. Project Feasibility and Management Studies	Lo	A	*	*	*
b. Technical Integration of Hardware and Software	Lo	Lo	*	*	*
2. Oil and Gas Processing and Refining Equipment and Technology	A	Lo			
a. Fluid Catalytic Cracking (FCC)	A	Lo			
b. Hydrocracking	O-Lo	O			
c. Reduced Crude Cracking (alternative to FCC)	O	O			
d. Hydroprocessing	Hi	Lo			
e. Delayed Coking and Fluid Coking	Hi	Lo			
f. Catalytic Reforming	A	Lo			
g. Hydrogen Fluoride Alkylation	O	O			
h. Equipment for Production of Additives for Lubes	Lo	O			
i. Gas Processing Plants	Lo	Lo	*	*	*

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WESTERN EQUIPMENT AND TECHNOLOGY NEEDED (*) FOR KEY SOVIET OIL AND GAS DEVELOPMENT PROJECTS 1985-2000

ITEM	ONSHORE				
	Astrakhan Gas/Cond.	Tenghiz Oil/Gas	Karachaganak Gas/Cond.	Zhanazhol Oil/Gas	N. Tyumen Oil/Gas
A. EXPLORATION TECHNOLOGY AND EQUIPMENT					
1. Exploration Technology (all phases)					
a. Project Feasibility and Management Studies	*	*	*	*	
b. Technical Integration of Hardware and Software	*	*	*	*	*
2. Exploration Geophysical Equipment (all types)					
a. Seismic Survey Vessels (equipment package - excluding hull and boat)					
b. Satellite Navigation Equipment					
c. Acoustical/Ultrasonic Sensors and Geophysical Equipment:					
(1) Geophones for Onshore and Offshore Seismic Surveying	*	*	*	*	*
(2) Land Gravimeters	*	*	*	*	
(3) Magneto-Telluric Systems					
(4) Well Logging Equipment	*	*	*	*	*
(5) Mud Logging Equipment	*	*	*	*	*
(6) Monitoring Equipment for Drilling Operations (Mud Systems) and Drill Stem Testing Equip.	*	*	*	*	*
(7) Computer Hardware	*	*	*	*	*
B. DRILLING AND PRODUCTION TECHNOLOGY AND EQUIPMENT					
1. Production Technology (all phases)					
a. Project Feasibility and Management Studies	*	*	*	*	*
b. Technical Integration of Hardware and Software	*	*	*	*	*
2. Production Equipment (all types)					
Of which:					
a. Corrosion Resistant Producing Equipment (all types)	*	*	*	*	*
(1) Christmas Trees and Blow-out Preventers	*	*	*	*	
(2) Remote Control Systems	*	*	*	*	*
(3) Well heads	*	*	*	*	
(4) Special Steel Tubes-Casing, Tubing, Drill Collars, Drill Pipe	*	*	*	*	*
(5) Packers, Seals, Valves	*	*	*	*	*
(6) Pump Rods		*		*	*
(7) Deep Submersible Pumps (below 600 m. depths)		*		*	*
(8) Manifold Systems	*	*	*	*	
(9) Chemical inhibitors	*	*	*	*	*
b. High Pressure-Temperature Production Equipment (all types)	*	*	*	*	*
(1) Christmas Trees and Blow-out Preventers	*	*	*	*	*
(2) Remote Control Systems	*	*	*	*	*
(3) Wellheads	*	*	*	*	
(4) Casing and Tubing	*	*	*	*	*
(5) Packers, Seals, Valves	*	*	*	*	*
(6) Deep Submersible Pumps (below 600 m. depths)		*		*	*
c. Deep Well Drilling Rigs and Tools (below 3000 m. depths onshore and offshore)	*	*	*	*	*
(1) Offshore Drilling Platforms					
(2) Measuring instruments and Control Systems	*	*	*	*	*
(3) Riser and Motion Compensation Systems					
(4) Dynamic Positioning Systems					
C. PIPELINE CONSTRUCTION TECHNOLOGY, MATERIALS, AND EQUIPMENT					
1. Pipeline Technology (all phases)					
a. Project Feasibility and Management Studies					
b. Technical Integration of Hardware and Software					
2. Pipeline Materials and Equipment (all types)					
a. Large Diameter Pipe (1020-1420mm diameter pipe)	*		*		*
b. Pipe Wrapping and Coating Materials	*	*	*	*	*
c. Large Diameter Valves (1020-1420mm bore)	*		*		*
d. Pipeline Control Systems	*	*	*	*	*
e. Turbine Drivers and Compressors (Aeroderivative; turbines)					*
f. Heavy Duty Pipelayers (over 50-ton load capacity)	*	*	*	*	*
D. GAS PROCESSING AND OIL REFINING TECHNOLOGY AND EQUIPMENT					
1. Technology (all phases)					
a. Project Feasibility and Management Studies	*	*	*	*	*
b. Technical Integration of Hardware and Software	*	*	*	*	*
2. Oil Processing and Refining Equipment and Technology					
a. Fluid Catalytic Cracking (FCC)					
b. Hydrocracking					
c. Reduced Crude Cracking (alternative to FCC)					
d. Hydroprocessing					
e. Delayed Coking and Fluid Coking					
f. Catalytic Reforming					
g. Hydrogen Fluoride Alkylation					
h. Equipment for Production of Additives for Lubes					
i. Gas Processing Plants	*	*	*	*	*

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[redacted] 25X1

and timely execution of the major energy exploration and development projects, both offshore and onshore, calls for infusions of advanced technology and high-quality equipment. [redacted] 25X1

Areas of Application

In general, access to Western state-of-the-art equipment and technology would probably cut most project development lead-times in half. Denial would cause Soviet oil exploration and development to proceed much more slowly in the future than in the past. The largest, most accessible onshore oil deposits in the USSR probably have already been found and developed. Onshore oil exploration efforts (which are supervised by the Soviet oil ministry) are shifting from the relatively shallow (above 3,000-meter depths) structural traps to deeper structural prospects and hard-to-locate stratigraphic traps. In some areas, the deeper drilling involves high-temperature, overpressured strata in extremely corrosive environments. Offshore oil prospecting (which is under the supervision of the Soviet gas ministry) is underway in the Caspian Sea, Baltic Sea, Barents Sea, and near Sakhalin in the Sea of Okhotsk. Soviet deep-water (over 60-meter depths) prospecting efforts have located some large structures in ice-free areas of the Barents Sea. Exploration of the Soviet Union's vast Arctic shelf, however, will require far more sophisticated equipment and technology than is currently available to the USSR. US and Canadian experts have developed and demonstrated technical solutions for most Arctic onshore development problems, but much work remains to be done for year-round offshore production operations. Soviet capability to explore offshore arctic deposits may be adequate for seasonal operations in ice-free water, but present development capability is low overall, and non-existent for year-round operations. [redacted] 25X1

Types of Technology and Equipment Desired

The most critical items of Western petroleum equipment and technology being sought for present and future development projects include state-of-the-art (computer-assisted in most cases) seismic and drilling equipment for oil exploration and specially designed production equipment packages for deep, high-pressure-and-temperature, corrosion resistant service. Acquisition of Western technology for integrating, designing, and producing this equipment will probably receive equal priority. [redacted] 25X1

Offshore Projects. To exploit its considerable offshore potential for deposits of oil and natural gas, the USSR has begun--with some initial success--offshore exploration in the deeper waters of the Barents and Okhotsk Seas. In the future, the Soviets will be attempting to acquire a great many offshore items for the Barents, Caspian, and Sakhalin development projects.

Deep Onshore Projects

Future Soviet oil and gas exploration and production activity will be concentrated at depths of 2,500 to 5,000 meters. For the areas where H_2S and CO_2 are present under high-pressure and high-temperature conditions, the Soviets must acquire equipment designed for severe service. In many cases, this equipment must be fabricated from specially alloyed steel possessing metallurgical properties capable of withstanding chloride and sulfide stress cracking, as well as being resistant to metal fatigue and brittleness.

[redacted] 25X1

[redacted] 25X1

Moreover, successful use of this equipment may require state-of-the-art chemical inhibitor technology and chemicals. The major items needed for planned deep "sour" oil and gas development projects at Astrakhan', Tenghiz, and Karachaganak, are listed in table 6. [redacted] 25X1

Potential Military Applications for Desired Technology and Equipment

The greatest potential for diversion of Western petroleum technology and equipment is believed to exist in the sale of state-of-the-art, or "high-level" offshore hardware and software. Much of present Western offshore technology was derived from the 1960s explosion in micro-electronics, computerization, and miniaturization of hardware that was developed by the aerospace industry. Offshore naval and marine technologies have benefited from the US oil industry's pioneering efforts in the development of motion compensation and dynamic positioning systems for offshore drilling and for the design, fabrication, and installation of tremendously large offshore production installations. Recent breakthroughs in offshore computer-assisted geophysical exploration and the integration of related hardware and software offer perhaps the greatest potential for a wide array of military applications. [redacted] 25X1

Much of the technology and equipment used in geophysical exploration has broad military-naval applications using image and signal data processing with realtime analysis for strategic and tactical warfare on land and sea, or in the air (targeting, mapping, locating). The advanced geophysical devices for magnetic, acoustical, and ultrasonic sensing, combined with state-of-the-art computer assisted technology, have greatly improved Western capability for strategic and tactical warfare. Gravimeters are used for missile guidance. Magneto-telluric systems are being used in the development of underground low-frequency military communications system. Magnetometers have upgraded magnetic anomaly detection (MAD) systems (locating and mapping areas with natural magnetic anomalies on the seafloor that could be used to conceal submarines). Magnetometers and acoustical sensors are used for locating, identifying, and tracking missile-launching and conventional tactical submarines and for conducting anti-submarine warfare (ASW) operations. Some submarines run quietly, and one of the best clues to their whereabouts is the garbage, organic waste, and effluent jettisoned at sea. Modern seismic surveying vessels--which have equipment for hydrocarbon analysis of water samples in addition to seismograph, gravimeter, magnetometer, sub-bottom profiling equipment--can detect this organic waste. The final product of these seismic vessel surveys represents state-of-the-art technology for image and signal data processing for real-time mapping and analysis. Even the mini-computers used for mundane well-and mud-logging purposes and for monitoring drilling operations were borrowed originally from military hardware and they are still designed to meet military specifications for arctic, desert, and naval use. [redacted] 25X1

The technologies embodied in corrosion-resistant production equipment and in equipment for high-pressure, high-temperature operating conditions are applicable to conventional and nuclear weapons development, naval-vessel nuclear propulsion systems, military rocket and jet engines. Casing and tubing using special steels for high collapse resistance in deep-well service and packers, downhole subsurface safety valves, and seals using high chromium-nickel alloys and diffusion coating for high temperature and pressure service

[redacted] 25X1

Table 6

Western Technology and Equipment Likely To Be On
Moscow's Shopping List During 1985-2000

For Offshore Projects:

- Seismic survey boats with simultaneous multi-survey capability using state-of-the-art computer hardware and software
- Drilling platforms and rigs (dynamic positioning and reentry capability)
- Production jackets and modules (ice-resistant models)
- Pipeline construction materials, equipment, barges
- Drilling and production equipment and services
  - Drill pipe, collars, tool joints, bits, risers
  - Instruments for on-line monitoring of all drilling operations and directional drilling
  - Blow-out preventers and controls
  - Casing, tubing, valves, packers, mandrels, seals
  - Wellheads, trees, valves, flowlines, gauges (for surface or seafloor installation)
  - Subsea manifolds and gathering systems
  - Submersible pumps, and cables for electric power supply
  - Offshore processing and treating equipment
  - Drilling fluid and mud-logging services
  - Instruments for wellbore coring, testing

For Deep Onshore Projects:

- Onshore seismic surveying equipment (including weight-dropping and vibration techniques) using state-of-the-art computer hardware and software
- Deep-drilling rigs equipped for severe service
- Sour (H_2S and CO_2) oil and gas manifold and gathering systems
- Sulfur and carbon dioxide extraction technology
- Sour (H_2S and CO_2) oil and gas processing and treating equipment
- Blow-out preventers and controls for severe service
- Drill pipe, collars, tool joints, bits, and special drilling tools for severe service
- Instruments for on-line monitoring of all drilling operations and directional drilling
- Corrosion-resistant casing, tubing, valves, packers, mandrels, seals, and related chemical inhibitor technology
- Wellheads, trees, valves, and flow lines for severe service
- Deep-pumping equipment (especially submersible pumps and pump rods for rod-and-beam pumps)
- Gas-lift equipment and compressor stations
- Drilling fluid and mud-logging services
- Instruments for well-bore coring, testing, measuring pressure and temperature, and logging

25X1

have application in underground nuclear testing, weapons emplacement silos, metallurgical and metal-processing technology for armor, gun barrels, cutting surfaces, and bearings. 25X1

Most Western state-of-the-art and high-level drilling and production equipment packages integrate sophisticated hardware and software capable of performance under severe operating conditions. The matching of components and technological properties of hardware (such as the tensile and yield strengths of pipe, the integrity and sealing properties of pipe connections under high pressure and temperature, the cutting and bearing technology embodied in drill bits, and the metallurgy for making drill bits and tungsten-carbide inserts, drillpipe, collars, casing, tubing, and pump rods), as well as the metal-processing and shaping technology used to manufacture these items, have the potential to help Soviet military/defense research. For example, state-of-the-art technology for manufacturing US drill-string components--drill pipe and drill collars and the connecting tool-joints for each--employs precision rotary forging, a process that results in a refined grain structure for optimum heat-treatment response. Presumably many kinds of pipe and seamless tubes designed to withstand severe torquing and other stressing, high pressure, and high temperature, as well as to provide corrosion-resistant service, could be made by this process. Such pipes could be used in nuclear propulsion plants for submarines, in nuclear research, in nuclear weapons plants, and possibly in military rocket and jet engines, to name a few potential applications. 25X1

Submersible pumps capable of operating at depths greater than 600 meters can be used for recovery of strategic petroleum reserves from underground caverns or saltdomes. US pumps offer greater lift capacity and reliability than Soviet pumps. The pipes, valves, and fittings used for petroleum refinery equipment utilize AISI austenitic 300 series and ferritic 400 series stainless steels while nuclear power plants use grade 316 stainless steel pipes and valves. Refinery grade steel is able to withstand higher pressure and temperature than nuclear grade steel used in some Soviet plants. 25X1

The US COCOM Proposal and Domestic Export Controls

During the past few years, the United States has developed a comprehensive policy aimed at stemming the flow of high-quality Western equipment and technology to the USSR and Warsaw Pact countries by expanding and upgrading export controls. A US delegation convinced our NATO allies that a review of certain oil, gas, and other high technology items not subject to COCOM control was in order. Thereafter, a formal US proposal addressing emerging technologies and petroleum equipment and technology items was tabled for review and discussion by a special COCOM Ad Hoc Study Group. Following numerous bilateral and multilateral discussions, several items were accepted for full COCOM control in January 1984. Partial control was obtained over several other items, and discussions on the remaining items were either temporarily deferred or dropped for negotiating purposes because unilateral US foreign policy controls covering the remaining exploration and production items were in place. The status of the US list of 22 items (the emerging technologies inventory and 21 oil and gas technology and equipment items) appears in table 7, together with a summary of their COCOM status and their coverage by present US foreign policy controls. 25X1

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Table 7

Status of US Oil and Gas/Other High Technology Proposals in COCOM (as of August 29, 1984)

Item	COCOM Status	US Control Status
Inventory of emerging technologies (Structure and modalities are in place, awaiting additions of specific technologies).	Ad Hoc Group agreed to recommend (2 countries <u>ad ref</u>).	Consideration pending.
Categories of equipment and technology proposed for COCOM controls		
(1) Deep submersible pumps	Not accepted by Ad Hoc Group.	No US control.
(2) Seismic survey vessels	Accepted during the List Review.	Individual equipment of concern requires a US validated license (being installed in a vessel does not remove this requirement).
(3) Navigation equipment (by satellite)	Accepted during the List Review.	If <u>aboard</u> the satellite, it is controlled by the ITAR; the ground portion which will come under control in COCOM is not now unilaterally controlled.
(4) Acoustic/ultrasonic underwater equipment		
(a) Geophones (certain types)	Accepted during the List Review	Marsh (underwater) use now interpreted by the US as controlled, though not explicitly mentioned; with new agreement, both these and land-use geophones at the capability levels of concern will be controlled by all COCOM members.
(b) Other	Deferred for further definition	Some could be controlled, if meeting the descriptions in CCL items 6598F (oil exploration systems) or 6191F or 6391F (oil production use).

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(5) Land gravimeters (certain types)	Accepted during the List Review	US does not have unilateral controls on these items; agreed controls will be new.
(6) Corrosion-resistant oil/gas equipment	Withdrawn.	Controlled unilaterally under CCL 6191F and/or 6391F.
(7) High pressure/temperature oil/gas equipment	Withdrawn.	Controlled unilaterally under CCL 6191F and/or 6391F.
(8) Deep well drilling rigs	Withdrawn.	Controlled unilaterally under CCL 6191F and/or 6391F.
(9) Magneto-telluric systems (10) Well-logging equipment (11) Mud-logging equipment	Magnetometer covered by IL-1571; other crucial portions of (9), (10), and (11) covered (by IL-1565); all 3 items withdrawn.	US control to the USSR applies to portions of magneto-telluric systems other than the magnetometer under CCL 6598F.
(12) Feasibility studies	Withdrawn; Ad Hoc Group recommending member governments take care to ensure that embargoed technology is not transferred through such studies.	US controls on technology all of concern apply.
Technology for integration of:		
(13) --magneto-telluric systems (14) --seismic survey vessels (15) --submersible vehicle systems (16) --offshore positioning and navigation systems (17) --deep well drilling rigs and systems (18) --high pressure/ temperature, corrosion-resistant oil/gas production equipment	Deferred pending List Review results on the software item and on the West German technology list. Items (14)-(18) were deferred on the same basis as (13).	US technical-data regulations apply to items (13)-(21); this technology is unilaterally controlled under section 379 of the Export Administration Regulations.

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Technology for the design, development and production of:

(19) --deep submersible pumps	US reconsidering, following discussion on pump materials, which may already be covered.
(20) --high pressure/temperature oil/gas systems	(20) and (21) being reconsidered by US on the same basis as (19).
(21) --corrosion resistant oil/gas systems	

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[redacted] 25X1

[redacted] 25X1

Impact of Denial of Technology and Equipment to the USSR

Basis for Denial

Four principal rationales have been advanced for the denial of energy technology and equipment:

1. The denied items have substantial, identifiable military application.

2. Lack of the denied items would impair the energy exploration and production effort to an extent that would sap the USSR's military, economic, and political strength directly, by affecting defense production and military operations, and indirectly, by forcing a reallocation of resources from other sectors of the economy to the energy sector.

3. Lack of the denied items would impair the energy exploration and production effort to an extent that would force a reduction in the USSR's energy exports, thereby (a) cutting its hard currency revenues and its ability to import high-technology production equipment and end items from the West and (b) possibly weakening its energy tie to Eastern Europe.

4. The denial would affect interests of both the Soviet energy sector and the West European equipment suppliers in a way that would reduce the likelihood of additional sales of Soviet natural gas to Western Europe, thereby reducing the potential risk to Western Europe's energy security. [redacted] 25X1

Factors Bearing on the Effectiveness of Denial

Determination that an item has substantial, identifiable military application implies that denial would prevent an enhancement of military capability associated with that application. [redacted] 25X1

It is axiomatic that the chances of finding new deposits of oil (the primary need) would be enhanced by use of state-of-the-art exploration technology and equipment. But the impact of energy production of an impairment of the USSR's energy exploration effort during the 1985-2000 period is a much less certain prospect. Even the immediate acquisition of exploration technology and equipment would not lead to new production until the mid-to-late-1990s because of the lead times involved in petroleum exploration and development--especially in northern Tyumen' and offshore. Impairment of the exploration effort would have much more serious consequences for production later on, when oil production probably will be declining by substantial amounts. [redacted] 25X1

Denial of production equipment for operation in corrosive and high-pressure, high-temperature environments would essentially halt progress in development of the petroleum resources in the Pre-Caspian Depression and Central Asia. It would also have serious--but not crippling--consequences for operations in West Siberia. At present, the Soviets rely on domestically manufactured equipment for the bulk of their oil and gas production effort. Judging the adequacy of this equipment is to some extent a matter of

[redacted] 25X1

semantics. The Soviets are succeeding in producing oil and gas with technology and equipment that is perhaps a decade behind the state-of-the-art. This results in high production costs for oil, reflecting the myriad of inefficiencies associated with the use of obsolescent equipment of poor quality. It also adversely affects the percentage of oil in place that will ultimately be recovered. The lack of corrosion-resistant equipment means more frequent well-repairs, with the concommitant drain on skilled labor and other resources. Finally, looking to the future, total reliance on domestic technology and equipment would mean an even faster scaling-up of the oil industry investment required to keep total crude oil production from falling more rapidly and a requirement for the domestic oil and gas equipment industry to improve greatly the quality of its products. These requirements will escalate as oil development moves into the exploitation of deeper deposits and encounters further reductions in new-well flow rates. 25X1

We judge that, even under the conditions indicated, the Soviet Union would be able to supply its own essential needs for oil, including those of the armed forces. Unilateral action by the United States would have limited impact. Concerted action by all COCOM members would slow many Soviet projects, raise their energy investment costs, and, in turn, impose costs on other sectors of the economy. It is possible that these added costs and delays could, if coupled with other considerations, promote tactical adjustments in Soviet foreign policy. But we do not believe these pressures would be sufficient to force basic changes in Soviet defense and foreign policies. 25X1

The indirect effects of raising energy investment costs would be felt mainly in other civilian investment programs. This would slow the upgrading of civilian industry, the construction of housing and other facilities providing social amenities, and achievement of the goals of the Food Program. We do not believe that the functioning of the economy and the welfare of the Soviet consumer would be affected sufficiently to force substantial change in domestic economic policy.

The implications of reduced availability of energy for export are examined in the accompanying paper, "Soviet Strategy Regarding Energy Exports," q. v. 25X1

4. Although certain of the Soviet natural gas projects, namely the sour-gas development efforts in the Pre-Caspian Depression and Central Asia, are highly vulnerable to denial of Western technology and equipment, Soviet gas production as a whole is not vulnerable. Shutting down the sour-gas development would mean more rapid exploitation of the huge reserves of Urengoy, Yamburg, and the Yamal Peninsula. The outlook for additional discoveries of natural gas, possibly in the Barents and Kara Seas, appears favorable, and it is likely that immeasurable reserves are trapped in the gas-hydrate formations rimming the Arctic seas to the east. 25X1

Because of the size and quality of the Tyumen' natural gas reserves, the development effort required to produce a given amount of energy in the form of natural gas is small in comparison with the costs of oil development. In essence, a relatively small number of wells will do the job, and Soviet equipment and technology are adequate for the gas development effort in northern Tyumen'. The USSR thus is likely to remain in a position to produce

 25X1

sufficient gas to accommodate planned domestic consumption and to offer greater volumes for export. 25X1

The USSR is rapidly becoming self-sufficient in the components necessary for construction of long-distance gas transmission pipelines. It is making some headway in producing large-diameter pipe for high-pressure gasline service and has developed a heavy-duty pipelayer capable of handling the large pipe. It still imports large tonnages of pipe and large numbers of Japanese pipelayers, however. The development of large (16- and 25-MW) gas turbines was accelerated during the 1981-82 US embargo, and the USSR now appears capable of supplying all or nearly all of its needs for turbines and compressors for gas transmission pipeline service. Items such as automated control systems, pipe coating and wrapping, and corrosion-prevention systems increase the efficiency and longevity of pipelines, but their absence does not prevent effective operation. We conclude that, short of denial of large-diameter high-pressure linepipe, the USSR will be able to produce and offer for sale large additional amounts of natural gas through the 1985-2000 period. 25X1

Embargoes and Their Impact

Total Embargo.--A unilateral US embargo covering the exports to the USSR and other Warsaw Pact countries of the technology and oil and gas equipment items that the US proposed for COCOM listing likely would achieve limited success for about one year. Beyond that period the effect would be diluted because of the widespread availability of comparable hardware and "know-how" in Western Europe and Japan, and to a lesser degree, in several Third World nations. Also, as has occurred in the past, new production facilities would be developed overseas for most embargoed items where non-US capability is presently lacking. Consequently, the principal long-run effect of a unilateral US embargo in the presence of such strong foreign competition would be abandonment of the market to non-US firms. 25X1

A multilateral US/COCOM embargo of the 22 items could, however, effectively limit Soviet oil and gas development to relatively shallow (less than 3,000 meters deep) onshore petroleum deposits for the next 4 to 5 years. A total embargo would impact severely on both the oil and gas industries, but only if pipe sales (including large-diameter linepipe, well casing, tubing, drill pipe, and drill collars) are controlled. Soviet ability to move forward with planned substitution of gas for oil would be impaired because of the lack of linepipe to build gas pipelines. Moreover, Soviet oil production would probably decline more rapidly over the next decade without proper seamless tubular steel. The oil industry needs Western drillpipe, casing, and tubing for deep drilling and production operations under severe temperatures, pressures, and corrosive conditions. If pipes are not controlled, the gas industry could expand at about the planned rate, but with slightly higher investment costs to cover the extensive development of a large number of shallow gas pools instead of concentrating on the more intensive development of the deeper zones of two or three large fields. Oil industry development would be little affected. 25X1

Embargo Limited to Offshore Hardware.--USSR energy production would suffer little from a limited US/COCOM embargo of Western offshore petroleum equipment and technology. The brunt of the impact would fall on long-term oil

25X1

[redacted] 25X1

production, but such an embargo would require multilateral cooperation by the US/COCOM countries. An immediate impact would be registered on Soviet offshore oil exploration efforts in the Barents Sea and Sakhalin projects if dynamic positioning equipment, motion-compensation systems, seafloor blow-out preventer stacks and trees designed for use with offshore drilling platforms and vessels were embargoed. [redacted] 25X1

An embargo of 3- to 4-years' duration on this critical Western equipment would greatly impede Soviet efforts to find and develop new offshore oil reserves. It would probably take the Soviet industry at least 5 to 10 years to develop comparable offshore equipment. [redacted] 25X1

The importance of offshore exploration and development is underscored by the shrinking number of accessible onshore alternatives remaining to be developed. The true oil potential of the best remaining areas in the USSR may not be realized in this century due to their remote, inaccessible location, and geologic depth. In East Siberia, for example, much of the vast land area has potential for oil accumulation but is virtually unexplored. [redacted] 25X1

<u>A Technology Option</u>.--An effective limited embargo on technology for manufacturing selected petroleum equipment items could be pursued in order to retard Soviet efforts to reduce dependency on the West over the long run. Close multilateral US/COCOM cooperation would also be required for this option. Recent Soviet purchases of plants to produce drill bits and seamless tubular steel (casing and tubing) and the acquisition of construction-yard installations for making offshore drilling platforms and production platforms transferred critical Western technology that should materially contribute to the eventual development of onshore Tyumen' and offshore petroleum deposits in the Caspian, Baltic, and Barents Seas. Additional Western help will be needed for development of all these areas, especially for development of deep onshore "sour" oil and gas deposits in the Pre-Caspian Depression. An embargo on the necessary technology could force Moscow to reallocate domestic resources immediately in order to develop technology to address these needs. [redacted] 25X1

A more subtle technology option that would have more immediate impact on the Soviet oil and gas industries might be achieved by working through the COCOM mechanism, but dropping the rubric of "oil and gas equipment and technology." The use of this terminology in the 1983 US proposal of 22 items proved offensive to some of the other COCOM countries, which argued that it smacked of "economic warfare." Instead, the United States could seek to raise the "threshold" of existing COCOM controls for electronic instruments and computer technology, and for the metallurgy and metal-working processes used for producing oil and gas equipment--but without specifying the connection with oil and gas equipment. [redacted] 25X1 In the event such a COCOM initiative is accepted by our allies, the effect achieved might be as broad in scope as that of a total embargo and it would slow the tempo of Soviet oil and gas development. [redacted] 25X1

<u>A Full-Decontrol Scenario</u>.--If present US/COCOM controls were lifted on all Western oil and gas technology and equipment items sought by the Soviet Union, we would expect that:

[redacted] 25X1

- The Soviets would continue to exercise caution in selecting US firms as prime contractors for major development projects like the Barents Sea or sour oil and gas development in the Pre-Caspian Depression. A continuation of a recent Soviet policy of limiting US participation to subcontracting through overseas subsidiaries and licensees can be expected unless there is some noticeable improvement in US-Soviet relations.
- In the absence of a broad improvement in US-Soviet relations, the Soviets would most likely press forward without US help on all currently planned projects, using West European and Japanese contractors and equipment when possible. This course of action would cause little noticeable reduction in the tempo of development, except in the case of the Barents Sea.
- Even if US-Soviet relations were to improve substantially, US firms would realize few immediate benefits because West European and Japanese banks offer better financial terms. Also, many of the other supplier countries are running trade deficits with the Soviets, a factor that influences Moscow's choice of prime contractors and leading equipment suppliers for large and technically demanding projects such as Barents Sea exploration and development. Nevertheless, major US participation might be sought for the Barents Sea project because of the magnitude of the financial and technical resources needed. Direct US participation could cut the expected normal 8-10 year lead time in half. 25X1

Appendix A

World-Wide Availability of Oil and Gas Equipment

Production Capability Code:

X = Highest, or state-of-the-art capability
Hi = More than adequate for needs
A = Adequate for most needs
Lo = Some capability, but inadequate for most needs
O = No demonstrated capability
Blank = Unknown

Note: The 22 items covered by US foreign policy controls and proposed for COCOM control are subsumed in the categories included in Section A (Exploration Technology and Equipmennt) and Section B (Drilling and Production Technology and Equipment) of this appendix. Except for certain turbines, the items covered by Section C (Pipeline Construction Technology, Materials, and Equipment) and Section D (Gas Processing and Oil Refining Technology and Equipment) are not subject to US controls.

Source: Analysis of data from Composite Catalog of Oil Field Equipment and Services 1984-85, published by Gulf Publishing Company.

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ITEM	WARSAW PACT		N. AMER. & W. EUR. COCOM COUNTRIES			
A. EXPLORATION TECHNOLOGY AND EQUIPMENT	USSR	EASTERN EUROPE	USA	CANADA	HNL[1]	FRANCE
1. Exploration Technology (all phases)	Lo	Lo	X	Hi	Hi	X
a. Project Feasibility and Management Studies	Lo	Lo	X	Hi	Hi	X
b. Technical Integration of Hardware and Software	Lo	Lo	X	Hi	Hi	X
2. Exploration Geophysical Equipment (all types)	Lo	Lo	X	Hi	A	Hi
a. Seismic Survey Vessels (equipment package - excluding hull and boat)	Lo	Lo	X	Hi	A	Hi
b. Satellite Navigation Equipment	Lo	Lo	X	Hi	Hi	Hi
c. Acoustical/Ultrasonic Sensors and Geophysical Equipment:						
(1) Geophones for Onshore and Offshore Seismic Surveying	Lo	Lo	X	A	A	A
(2) Land Gravimeters	Lo	Lo	X	A	A	A
(3) Magneto-Telluric Systems	Hi	A				
(4) Well Logging Equipment	Lo	Lo	X	A	A	A
(5) Mud Logging Equipment	Lo	Lo	X	A	A	A
(6) Monitoring Equipment for Drilling Operations (Mud Systems) and Drill Stem Testing Equip.	Lo	Lo	X	A	A	Hi
(7) Computer Hardware	Lo	Lo	X	A	Hi	Hi
B. DRILLING AND PRODUCTION TECHNOLOGY AND EQUIPMENT						
1. Production Technology (all phases)	Lo	Lo	X	Hi	Hi	Hi
a. Project Feasibility and Management Studies	Lo	Lo	X	Hi	Hi	Hi
b. Technical Integration of Hardware and Software	Lo	Lo	X	Hi	Hi	Hi
2. Production Equipment (all types)	Lo-A	Lo-A	X	Hi	Lo	Hi
Of which:						
a. Corrosion Resistant Producing Equipment (all types)	Lo	Lo	X	Hi	A	Hi
(1) Christmas Trees and Blow-out Preventers	Lo	Lo	X	X	A	Hi
(2) Remote Control Systems	O	Lo	X	X	O	Hi
(3) Well heads	Lo	Lo	X	X	A	Hi
(4) Special Steel Tubes-Casing, Tubing, Drill Collars, Drill Pipe	Lo	Lo	X	Hi	Lo	Hi
(5) Packers, Seals, Valves	Lo	Lo	X	A	O	A
(6) Pump Rods	Lo	Lo	X	A	O	A
(7) Deep Submersible Pumps (below 600 m. depths)	Lo	Lo	X	O	O	A
(8) Manifold Systems	Lo	Lo	X	X	Hi	Hi
(9) Chemical Inhibitors	Lo	Lo	X	X	Hi	Hi
b. High Pressure-Temperature Production Equipment (all types)	Lo	Lo	X	Hi	Lo	Hi
(1) Christmas Trees and Blow-out Preventers	Lo	A	X	X	Lo	Hi
(2) Remote Control Systems	O	Lo	X	X	A	Hi
(3) Well Heads	A	A	X	Hi	Hi	Hi
(4) Casing and Tubing	Lo	Lo	X	X	Hi	Hi
(5) Packers, Seals, Valves	Lo	Lo	X	A	O	A
(6) Deep Submersible Pumps (below 600 m. depths)	Lo	Lo	X	O	O	A
c. Deep Well Drilling Rigs (below 3000 m. depths) and Tools	Lo-A	Lo-A	X	Hi	Hi	Hi
(1) Offshore Drilling Platforms	Lo	Lo	X	Hi	Hi	Hi
(2) Measuring Instruments and Control Systems	Lo	Lo	X	Hi	A	Hi
(3) Riser and Motion Compensation Systems	Lo	Lo	X	Hi	Hi	Hi
(4) Dynamic Positioning Systems	Lo	Lo	X	A	Hi	Hi
C. PIPELINE CONSTRUCTION TECHNOLOGY, MATERIALS, AND EQUIPMENT						
1. Pipeline Technology (all phases)	A	A	X	X	Hi	Hi
a. Project Feasibility and Management Studies	A	Lo	X	X	Hi	Hi
b. Technical Integration of Hardware and Software	A	Lo	X	X	Hi	Hi
2. Pipeline Materials and Equipment (all types)	Lo	Lo	X	X	Hi	Hi
a. Large Diameter Pipe (1020-1420mm diameter pipe)	Lo	Lo	Hi	X	Hi	Hi
b. Pipe Wrapping and Coating Materials	Lo	Lo	X	X	A	Hi
c. Large Diameter Valves (1020-1420mm bore)	Lo-A	Lo	X	Hi	X	X
d. Pipeline Control Systems	Lo	Lo	X	X	X	X
e. Turbine Drivers and Compressors	A	Lo	X	Hi	Hi	Hi
f. Heavy Duty Pipelayers (over 50 Ton Load Capacity)	A	Lo	X	O	O	O
D. PROCESSING AND REFINING TECHNOLOGY AND EQUIPMENT						
1. Technology (all phases)	Lo	A	X	X	X	X
a. Project Feasibility and Management Studies	Lo	A	X	X	X	X
2. Processing and Refining Equipment (all phases)	Lo-A	Lo	X	X	X	X
a. Fluid Catalytic Cracking (FCC)	Lo-A	Lo	X	X	X	X
b. Hydrocracking	O-Lo	O	X	Hi	Hi	A
c. Reduced Crude Cracking (alternative to FCC)	O	O	X	O	O	O
d. Hydroprocessing	Hi	Lo	X	X	X	X
e. Delayed Coking and Fluid Coking	Hi	Lo	X	Hi	Hi	Hi
f. Catalytic Reforming	A	Lo	X	X	X	X
g. Hydrogen Fluoride Alkylation	O	O	X	A	A	A
h. Equipment for Production of Additives for Lubes	Lo	Lo	X	Hi	X	Hi
i. Gas Processing Plants	Lo	Lo	X	Hi	Hi	Hi

[1] Includes Shell Oil.

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ITEM	N. AMER. & W. EUR. COCOM COUNTRIES				WESTERN EUROPE-NON-COCOM			
	FRG	ITALY	NORWAY	UK[2]	AUSTRIA	FINLAND	SWEDEN	SWITZER-LAND
A. EXPLORATION TECHNOLOGY AND EQUIPMENT								
1. Exploration Technology (all phases)	Hi	Hi	Hi	X	A	O	O	
a. Project Feasibility and Management Studies	Hi	Hi	Hi	X	A	O	O	
b. Technical Integration of Hardware and Software	Hi	Hi	Hi	X	A	O	Lo	
2. Exploration Geophysical Equipment (all types)	A	A	A	Hi	Lo	Lo	Lo	
a. Seismic Survey Vessels (equipment package - excluding hull and boat)	A	A	A	Hi	Lo	Lo	Lo	
b. Satellite Navigation Equipment	Hi	Hi	Hi	Hi	Lo	Hi	Hi	
c. Acoustical/Ultrasonic Sensors and Geophysical Equipment:								
(1) Geophones for Onshore and Offshore Seismic Surveying	A	O	O	Hi	O	O	O	
(2) Land Gravimeters	A	O	O	Hi	O	O	X	
(3) Magneto-Telluric Systems								
(4) Well Logging Equipment	A	O	O	Hi	O	O	O	
(5) Mud Logging Equipment	A	O	O	Hi	O	O	O	
(6) Monitoring Equipment for Drilling Operations (Mud Systems) and Drill Stem Testing Equip.	A	O	A	Hi	O	O	O	
(7) Computer Hardware	Hi	Hi	A	Hi	O	O	O	
B. DRILLING AND PRODUCTION TECHNOLOGY AND EQUIPMENT								
1. Production Technology (all phases)	Hi	Hi	Hi	Hi	Hi	O	O	
a. Project Feasibility and Management Studies	Hi	Hi	Hi	Hi	Hi	O	O	
b. Technical Integration of Hardware and Software	Hi	Hi	Hi	Hi	Hi	O	O	
2. Production Equipment (all types)	Hi	Hi	Lo	Hi	A	Lo	O	
Of which:								
a. Corrosion Resistant Producing Equipment (all types)	Hi	Hi	Lo	Hi	A	Lo	Lo	
(1) Christmas Trees and Blow-out Preventers	Hi	Hi	O	Hi	A	O	O	
(2) Remote Control Systems	O	O	Hi	Hi	A	A	O	
(3) Well heads	Hi	Hi	A	Hi	Hi	O	O	
(4) Special Steel Tubes-Casing, Tubing, Drill Collars, Drill Pipe	Hi	Hi	O	Lo	Hi	O	Hi	
(5) Packers, Seals, Valves	Lo	Lo	O	Hi	Lo	O	O	
(6) Pump Rods	Hi	A	O	A	Hi	O	O	
(7) Deep Submersible Pumps (below 600 m. depths)	O	O	O	O	O	O	O	
(8) Manifold Systems	Hi	Hi	Hi	Hi	Hi	Lo	Lo	
(9) Chemical Inhibitors	Hi	Hi	Hi	Hi	Hi	O	O	
b. High Pressure-Temperature Production Equipment (all types)	Hi	Hi	Lo	Hi	Lo	O	Lo	
(1) Christmas Trees and Blow-out Preventers	Hi	Hi	Lo	Hi	A	O	O	
(2) Remote Control Systems	A	A	Hi	Hi	A	A	O	
(3) Well Heads	Hi	Hi	Lo	Hi	A	O	Lo	
(4) Casing and Tubing	Hi	Hi	Lo	Hi	Hi	O	Hi	
(5) Packers, Seals, Valves	Lo	Lo	O	Hi	Lo	O	O	
(6) Deep Submersible Pumps (below 600 m. depths)	O	O	O	O	O	O	O	
c. Deep Well Drilling Rigs (below 3000 m. depths) and Tools	Hi	Hi	Hi	Hi	Hi	A	O	
(1) Offshore Drilling Platforms	Hi	Hi	Hi	Hi	O	A	A	
(2) Measuring Instruments and Control Systems	Hi	A	Lo	A	A	O	O	
(3) Riser and Motion Compensation Systems	Hi	Hi	Hi	Hi	O	O	O	
(4) Dynamic Positioning Systems	Hi	Hi	Hi	Hi	O	O	O	
C. PIPELINE CONSTRUCTION TECHNOLOGY, MATERIALS, AND EQUIPMENT								
1. Pipeline Technology (all phases)	Hi	Hi	Hi	Hi	A	O	O	
a. Project Feasibility and Management Studies	Hi	Hi	Hi	Hi	A	O	O	
b. Technical Integration of Hardware and Software	Hi	Hi	Hi	Hi	A	O	O	
2. Pipeline Materials and Equipment (all types)	Hi	Hi	Lo	Hi	Lo	O	Lo	
a. Large Diameter Pipe (1020-1420mm diameter pipe)	X	X	O	Hi	A	O	Hi	
b. Pipe Wrapping and Coating Materials	X	Hi	Lo	Hi	Lo	O	O	
c. Large Diameter Valves (1020-1420mm bore)	X	X	O	Hi	O	O	O	
d. Pipeline Control Systems	X	X	Hi	X	O	O	O	
e. Turbine Drivers and Compressors	Hi	Hi	O	X	O	O	Hi	Hi
f. Heavy Duty Pipelayers over 50-ton load capacity	O	X	O	O	O	O	O	
D. PROCESSING AND REFINING TECHNOLOGY AND EQUIPMENT								
1. Technology (all phases)	X	X	A	X	Hi	A	A	
a. Project Feasibility and Management Studies	X	X	A	X	Hi	A	A	
2. Processing and Refining Equipment (all phases)	X	X	Lo	X	A	Lo	A	
a. Fluid Catalytic Cracking (FCC)	X	X	Lo	X	A	Lo	A	
b. Hydrocracking	Hi	Lo	Lo	Hi	A	Lo	A	
c. Reduced Crude Cracking (alternative to FCC)	O	O	O	O	O	O	O	
d. Hydroprocessing	X	X	Lo	X	Lo	Lo	Lo	
e. Delayed Coking and Fluid Coking	Hi	Hi	O	Hi	Lo	Lo	Lo	
f. Catalytic Reforming	X	X	O	X	A	A	A	
g. Hydrogen Fluoride Alkylation	Lo	Lo	O	A	O	O	O	
h. Equipment Production of Additives for Lubes	Hi	Hi	A	X	A	A	A	
i. Gas Processing Plants	Hi	Hi		Hi				

[2] Includes Shell, BP, et al.

25X1

ITEM	ASIA-COCOM	ASIA-NON-COCOM			
	JAPAN	INDIA	SINGAPORE	SOUTH KOREA	TAIWAN
A. EXPLORATION TECHNOLOGY AND EQUIPMENT					
1. Exploration Technology (all phases)	Hi	Lo	Lo	O	O
a. Project Feasibility and Management Studies	Hi	A	Lo	O	O
b. Technical Integration of Hardware and Software	Hi	Lo	A	O	Lo
2. Exploration Geophysical Equipment (all types)	Lo	O	Lo	O	Lo
a. Seismic Survey Vessels (equipment package - excluding hull and boat)	Lo	O	Lo	O	Lo
b. Satellite Navigation Equipment	Hl	O	Lo	O	Lo
c. Acoustical/Ultrasonic Sensors and Geophysical Equipment:					
(1) Geophones for Onshore and Offshore Seismic Surveying	O	O	Lo	O	Lo
(2) Land Gravimeters	O	O	Lo	O	Lo
(3) Magneto-Telluric Systems					
(4) Well Logging Equipment	O	O	Lo	O	O
(5) Mud Logging Equipment	A	O	Lo	O	O
(6) Monitoring Equipment for Drilling Operations (Mud Systems) and Drill Stem Testing Equip.	A	O	Lo	O	O
(7) Computer Hardware	Hi	O	Lo	O	Lo
B. DRILLING AND PRODUCTION TECHNOLOGY AND EQUIPMENT					
1. Production Technology (all phases)	Hi	A	Hi	O	A
a. Project Feasibility and Management Studies	Hi	A	Hi	O	A
b. Technical Integration of Hardware and Software	Hi	A	Hi	O	A
2. Production Equipment (all types)	Hi	Lo	A	O	Lo
Of which:					
a. Corrosion Resistant Producing Equipment (all types)	Lo	Lo	Lo	O	O
(1) Christmas Trees and Blow-out Preventers	Lo	O	Lo	O	O
(2) Remote Control Systems	O	O	O	O	O
(3) Well heads	Lo	O	Lo	O	O
(4) Special Steel Tubes-Casing, Tubing, Drill Collars, Drill Pipe	Hi	O	Lo	Lo	O
(5) Packers, Seals, Valves	O	O	O	O	O
(6) Pump Rods	A	O	Lo	O	O
(7) Deep Submersible Pumps (below 600 m. depths)		O	O	O	O
(8) Manifold Systems	Hi	A	A	O	Lo
(9) Chemical Inhibitors	A	A	A	O	O
b. High Pressure-Temperature Production Equipment (all types)	Lo	Lo	Lo	O	O
(1) Christmas Trees and Blow-out Preventers	Lo	Lo	Lo	O	O
(2) Remote Control Systems	A	O	O	O	O
(3) Well Heads	Hi	A	A	Lo	O
(4) Casing and Tubing	Hi	A	A	Hi	O
(5) Packers, Seals, Valves	O	O	Lo	O	O
(6) Deep Submersible Pumps (below 600 m. depths)	O	O	O	O	O
c. Deep Well Drilling Rigs (below 3000 m. depths) and Tools	hi	O	Hi	O	O
(1) Offshore Drilling Platforms	Hi	A	O	Hi	O
(2) Measuring Instruments and Constrol Systems	Hi	O	O	O	O
(3) Riser and Motion Compensation Systems	Hi	O	O	O	O
(4) Dynamic Positioning Systems	Hi	O	O	O	O
C. PIPELINE CONSTRUCTION TECHNOLOGY MATERIALS AND EQUIPMENT					
1. Pipeline Technology (all phases)	Hi	A	A	O	O
a. Project Feasibility and Management Studies	Hi	A	A	O	O
2. Pipeline Materials and Equipment (all types)	Hi	Lo	Lo	O	O
a. Large Diameter Pipe (1020-1420mm diameter pipe)	X	O	O	O	O
b. Pipe Wrapping and Coating Materials	Hi	O	O	O	O
c. Large Diameter Valves (1020-1420mm bore)	X	O	O	O	O
d. Pipeline Control Systems	Hi	O	O	O	O
e. Turbine Drivers and Compressors	Hi	O	O	O	O
f. Heavy Duty Pipelayers over 50-ton load capacity	X	O	O	O	O
D. PROCESSING AND REFINING TECHNOLOGY AND EQUIPMENT					
1. Technology (all types)	X	A	Hi	A	A
a. Project Feasibility and Management Studies	X	A	Hi	A	A
2. Processing and Refining Equipment (all types)	X	Lo	Hi	Lo	Lo
a. Fluid Catalytic Cracking (FCC)	X	Lo	Hi	Lo	Lo
b. Hydrocracking	Hi	Lo	Hi	Lo	Lo
c. Reduced Crude Cracking (alternative to FCC)	X	O	O	O	O
d. Hydroprocessing	X	Lo	A	Lo	Lo
e. Delayed Coking and Fluid Coking	Hi	Lo	A	Lo	Lo
f. Catalytic Reforming	X				
g. Hydrogen Fluoride Alkylation	Lo	O	O	O	O
h. Equipment for Production of Additives for Lubes	Hi	Lo	Lo	Lo	O
i. Gas Processing Plants	Hi				

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ITEM	LATIN AMERICA--NON-COCOM				
	ARGENTINA	BRAZIL	MEXICO	PERU	VENEZUELA
A. EXPLORATION TECHNOLOGY AND EQUIPMENT					
1. Exploration Technology (all phases)	A	A	A	A	A
a. Project Feasibility and Management Studies	A	A	A	A	A
b. Technical Integration of Hardware and Software	A	A	A	A	A
2. Exploration Geophysical Equipment (all types)	O	O	O	O	O
a. Seismic Survey Vessels (equipment package - excluding hull and boat)	O	O	O	O	O
b. Satellite Navigation Equipment	O	Lo	O	O	O
c. Acoustical/Ultrasonic Sensors and Geophysical Equipment:					
(1) Geophones for Onshore and Offshore Seismic Surveying	O	O	O	O	O
(2) Land Gravimeters	O	O	O	O	O
(3) Magneto-Telluric Systems					
(4) Well Logging Equipment	O	O	O	O	O
(5) Mud Logging Equipment	O	O	O	O	O
(6) Monitoring Equipment for Drilling Operations (Mud Systems) and Drill Stem Testing Equip.	O	O	O	O	O
(7) Computer Hardware	O	O	O	O	O
B. DRILLING AND PRODUCTION TECHNOLOGY AND EQUIPMENT					
1. Production Technology (all phases)	A	Hi	Hi	A	Hi
a. Project Feasibility and Management Studies	A	Hi	Hi	A	Hi
b. Technical Integration of Hardware and Software	A	Hi	Hi	A	Hi
2. Production Equipment (all types)	Lo	Lo	Lo	Lo	Lo
Of which:					
a. Corrosion Resistant Producing Equipment (all types)	Lo	Lo	Lo	O	Lo
(1) Christmas Trees and Blow-out Preventers	Lo	Lo	Lo	Lo	Lo
(2) Remote Control Systems	O	O	O	Lo	O
(3) Well heads	Lo	Lo	Lo	Lo	Lo
(4) Special Steel Tubes-Casing, Tubing, Drill Collars, Drill Pipe	Hi	Hi	A	O	A
(5) Packers, Seals, Valves	Lo	A	A	O	A
(6) Pump Rods	A	O	O	O	O
(7) Deep Submersible Pumps (below 600 m. depths)	O	O	O	O	O
(8) Manifold Systems	A	Hi	Hi	O	Hi
(9) Chemical Inhibitors	A	A	A	O	A
b. High Pressure-Temperature Production Equipment (all types)	Lo	Lo	Lo	O	Lo
(1) Christmas Trees and Blow-out Preventers	Lo	Lo	Lo	Lo	Lo
(2) Remote Control Systems	O	O	O	Lo	O
(3) Well Heads	Lo	A	Hi	Lo	A
(4) Casing and Tubing	Hi	Hi	Hi	O	A
(5) Packers, Seals, Vaives	Lo	A	A	O	A
(6) Deep Submersible Pumps (below 600 m. depths)	O	O	O	O	O
c. Deep Well Drilling Rigs (below 3000 m. depths) and Tools	A	A	A	O	O
(1) Offshore Drilling Platforms	A	A	A	O	A
(2) Measuring Instruments and Control Systems	O	O	O	O	O
(3) Riser and Motion Compensation Systems	O	O	O	O	O
(4) Dynamic Positioning Systems	O	O	O	O	O
C. PIPELINE CONSTRUCTION TECHNOLOGY MATERIALS AND EQUIPMENT					
1. Pipeline Technology (all phases)	A	A	A	Lo	A
a. Project Feasibility and Management Studies	A	A	A	Lo	A
b. Technical Integration of Hardware and Software	A	A	A	Lo	Lo
2. Pipeline Materials and Equipment (all types)	Lo	Lo	Lo	O	O
a. Large Diameter Pipe (1020-1420mm diameter pipe)	O	O	O	O	O
b. Pipe Wrapping and Coating Materials	O	O	O	O	O
c. Large Diameter Valves (1020-1420mm bore)	O	O	O	O	O
d. Pipeline Control Systems	O	O	O	O	O
e. Turbine Drivers and Compressors	O	O	O	O	O
f. Heavy Duty Pipelayers over 50-ton load capacity	O	O	O	O	
D. PROCESSING AND REFINING TECHNOLOGY AND EQUIPMENT					
1. Technology (all phases)	A	A	A	Lo	A
a. Project Feasibility and Management Studies	A	A	A	Lo	A
2. Processing and Refining Equipment (all phases)	Lo	Lo	Lo	Lo	Lo
a. Fluid Catalytic Cracking (FCC)	Lo	Lo	Hi	Lo	Hi
b. Hydrocracking	Lo	Lo	Lo	Lo	Lo
c. Reduced Crude Cracking (alternative to FCC)	O	O	O	O	Lo
d. Hydroprocessing	Lo	Lo	Lo	Lo	A
e. Delayed Coking and Fluld Coking	Lo	Lo	Lo	O	A
f. Catalytic Reforming	A	A	A	Lo	
g. Hydrogen Fluoride Alkylation	O	O	O	O	O
h. Equipment for Production of Additives for Lubes	Lo	Lo	Lo	O	Lo
i. Gas Processing Plants			A		A

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